Landsat 7
Processing System (LPS)
Operations and Maintenance Manual

SIGNATURE

November 27, 1996

GODDARD SPACE FLIGHT CENTER
GREENBELT, MARYLAND

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Prepared by:

11/27/96

Danh Nguyen Date
Engineering Specialist
Landsat 7 Processing System
cNMOS
Lockheed-Martin

Reviewed by:

12/4/96

Robert Schweiss Date
Systems Engineering Manager
Landsat 7 Processing System
Code 514
Goddard Space Flight Center

Reviewed by:

11/27/96

Neil Ottenstein Date
Systems Engineer
Landsat 7 Processing System
cNMOS
Computer Sciences Corporation

Reviewed by:

12/4/96

Clifford K. Brambora Date
Hardware Engineering Manager
Landsat 7 Processing System
Code 514
Goddard Space Flight Center

Concurred by:

11-26-96

Nathaniel Daniel Date
Project Manager
Landsat 7 Processing System
cNMOS
Computer Sciences Corporation

Approved by:

12/5/96

Joy Henegar Date
Project Manager
Landsat 7 Processing System
Code 514
Goddard Space Flight Center

List of TBDs, TBRs, and TBSs

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Preface

This manual contains operations and maintenance information for the Landsat 7 Processing System (LPS). This document will be continually updated to reflect the latest configuration of the LPS. Direct comments and questions regarding this document to

Landsat 7 Processing System Project
Code 514
Goddard Space Flight Center
Greenbelt, MD 20771

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Section 1 — Introduction

1.1 Purpose and Scope of Manual

This operations and maintenance (O&M) manual contains information for the hardware maintenance and basic operation of the Landsat 7 Processing System (LPS). Described in this manual are the physical and functional characteristics, site requirements, setup procedures, hardware description, maintenance procedures, parts lists, and schematic diagrams.

The operation section of this manual is limited to equipment startup and shutdown procedures including login and logout. These basic procedures are provided to facilitate maintenance activities and the system configuration procedures. The detail operation of the LPS data processing software is beyond the scope of this document. The complete details of the LPS data operation procedures can be found in the *Landsat 7 Processing System User's Guide (Applicable Document 1.4.10).* The information contained in this O&M manual is intended to provide a functional platform for the operational software.

Additionally, a detailed description of the LPS application software is contained in the *Landsat 7 Processing System Detailed Design Specification* and the *Landsat 7 Processing System System Design Specifications* (Applicable Document 1.4.7 and 1.4.9, respectively).

1.2 Landsat 7 Processing System Description

The LPS captures (receives and stores) Landsat 7 Enhanced Thematic Mapper Plus (ETM+) data from the Landsat 7 Ground System (LGS). These ETM+ data are transmitted to the LGS during a Landsat 7 contact. LPS receives the demodulated data from LGS in real-time. Once the ETM+ data have been processed by the LPS, they are transferred to the Earth Resources Observation Systems (EROS) Data Center (EDC) Distributed Active Archive Center (DAAC) for distribution to the end users. An interface and data flow context of LPS to Landsat 7 Ground Systems is shown in Figure 1-1. Additional information on the LPS and its interfaces to the other Landsat systems can be found in the reference documents listed in Section 1.4.

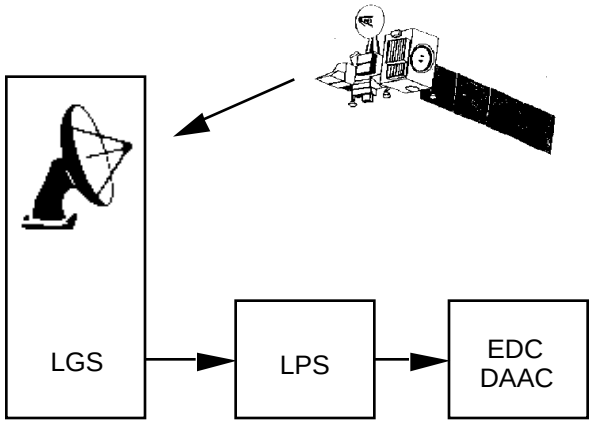


Figure 1-1. LPS interfaces to Landsat 7 Ground Systems

An operational hardware configuration of the LPS is shown in Figure 1-2. The LPS comprises five identical strings and associated peripherals. During normal operations, the LPS strings receive serial ECL NRZ-L data and clock from the LGS Matrix Switch at the wideband data rate of 75 Mbits/sec. A maximum of any four of the five strings can receive data during a contact. The fifth string is used as a backup and to support system test and development. Additionally, the LPS strings can transmit data back to the switch for test purposes.

During a Landsat 7 contact, the LPS strings temporarily store the received ETM+ raw data on a redundant array of independent drives (RAID) located in the RAID/DLT cabinet. This RAID is designated the "capture RAID." Once the contact is complete, Level 0R (L0R) data processing is performed on the ETM+ data. The L0R output files are stored on a second RAID, also located in the RAID/DLT cabinet, for subsequent transfer to the EDC DAAC. This RAID is designated the "transfer RAID." Each RAID can store 32 GBytes of data.

The controller for each string is a Silicon Graphics, Inc. (SGI), Challenge XL Network Resource Server. The Challenge XL performs the data processing tasks. Included with the Challenge XL are a 4mm digital audio tape (DAT) drive, a 8mm tape drive, a compact disk read only memory (CD-ROM) drive , and a 4.3 GBytes system disk.

The RAID/DLT cabinet contains a digital linear tape (DLT) Library for short-term data archiving. During L0R processing, the raw ETM+ data are transferred from the capture RAID to the DLT for 30-day archive.

Two X terminals, three Indy workstations and one IRISconsole provide operator interface. Two of the Indy workstations are used to

display compressed images of the ETM+ sensor data during L0R processing. These two Indys provide four windows (two windows per Indy) for displaying images from four LPS strings. The image displayed on the window is referred to call as a "moving window display." A LANCAST 10BaseT Smart Hub provides the network interface between the LPS local area network (LAN) to the EDC LAN. Five label printers are provided (one for each LPS string) to generate the DLT cassette labels. Two laser printers are used for report generation.

1.3 Equipment Supplied

Each LPS string contains an SGI Challenge XL network resource server, Model CMN A010. Figure 1-3 shows the front view of the Challenge XL.

The Challenge XL storage devices include the following:

A. 4.3 GB system disk

B. CD ROM)

C. 4mm DAT drive

D. 8mm tape drive

Figure 1-4 depicts the rear view of the Challenge XL showing connector locations.

Figure 1-5 shows the rear view of the cardcage. The SGI portion of the cardcage contains the following:

A. Four RAM boards (128 MBytes per board, 512 MBytes per XL)

B. Two CPU boards (each CPU board contains four 250 Mhz R4400 processors, for a total of eight processors per XL)

C. Input/Output (IO4) board #1 (includes VMEbus channel adapter module (VCAM) board for VME bus interface).

D. Input/Output (IO4) board #2 (has additional SCSI-2 mezzanine board and FDDI mezzanine board)

Each SGI Challenge XL has an internal VME backplane. A VCAM board provides the interface between the SGI backplane and the VME backplane. The VME chassis of each Challenge XL has a General Standards Corporation HPDI/VSIO board, which is used to convert

the high-speed serial data stream to parallel data. More details of the HPDI/VSIO board can be found in Section 5 of this O&M manual.

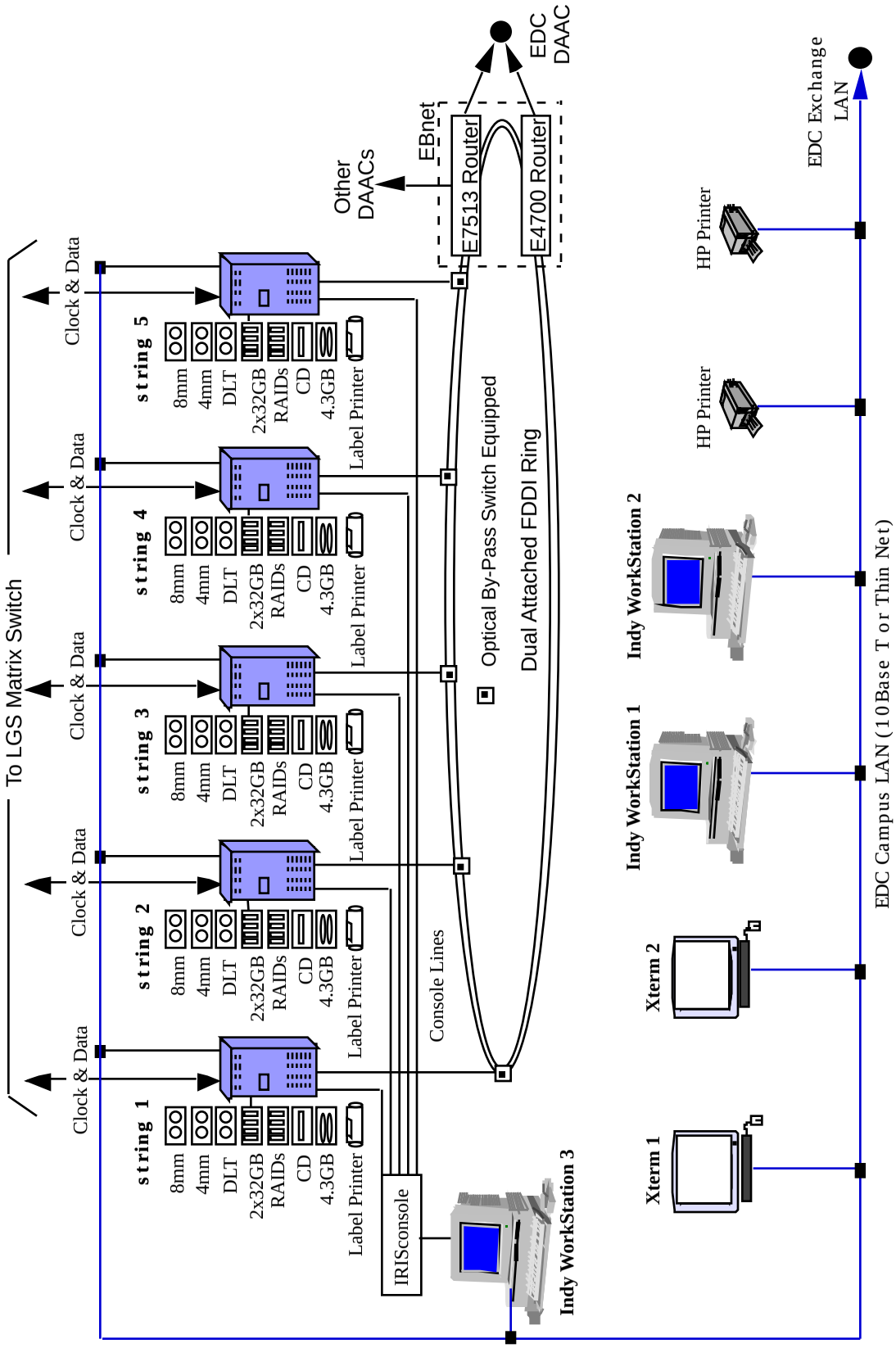


Figure 1-2. Operational Hardware Configuration

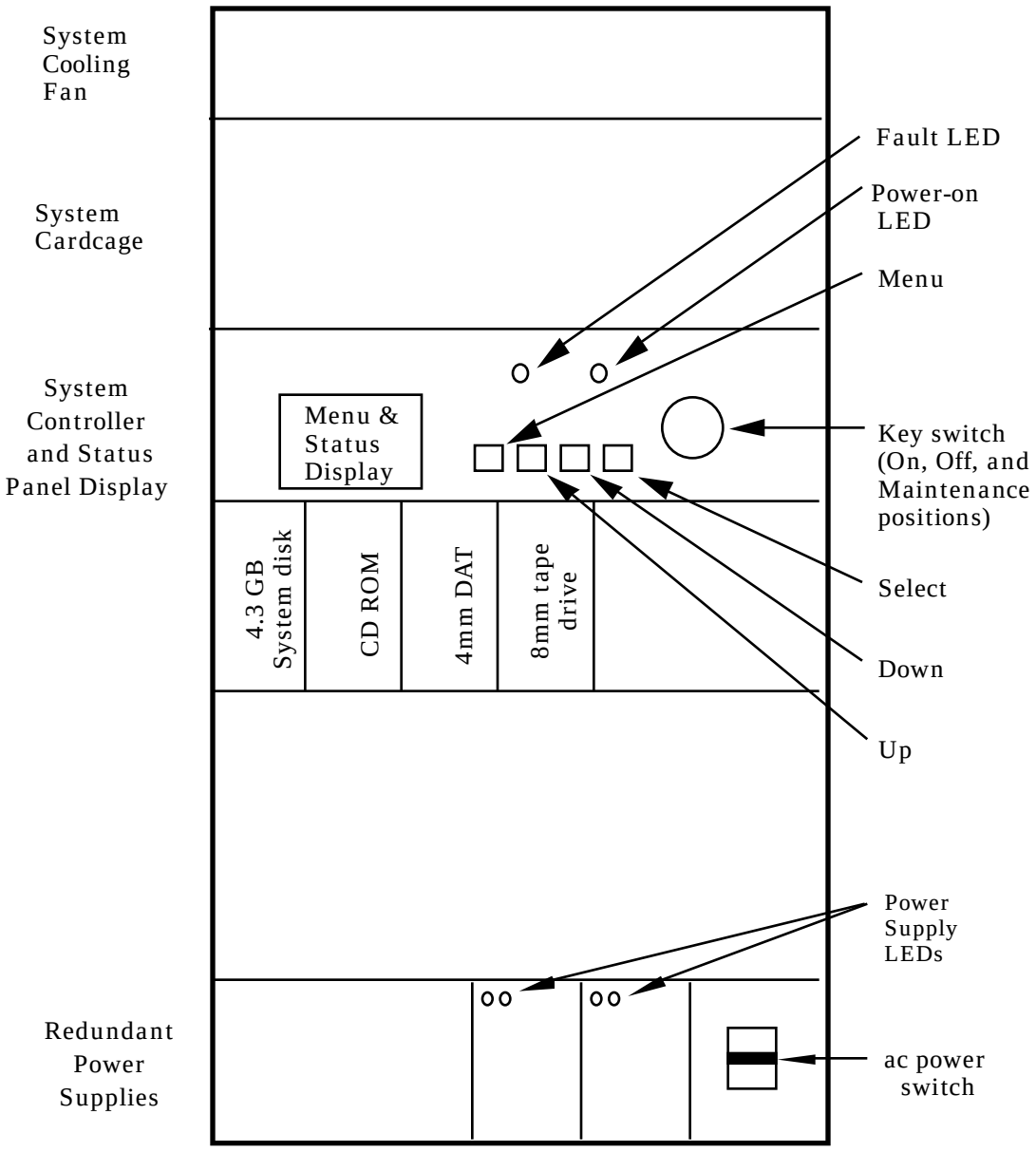
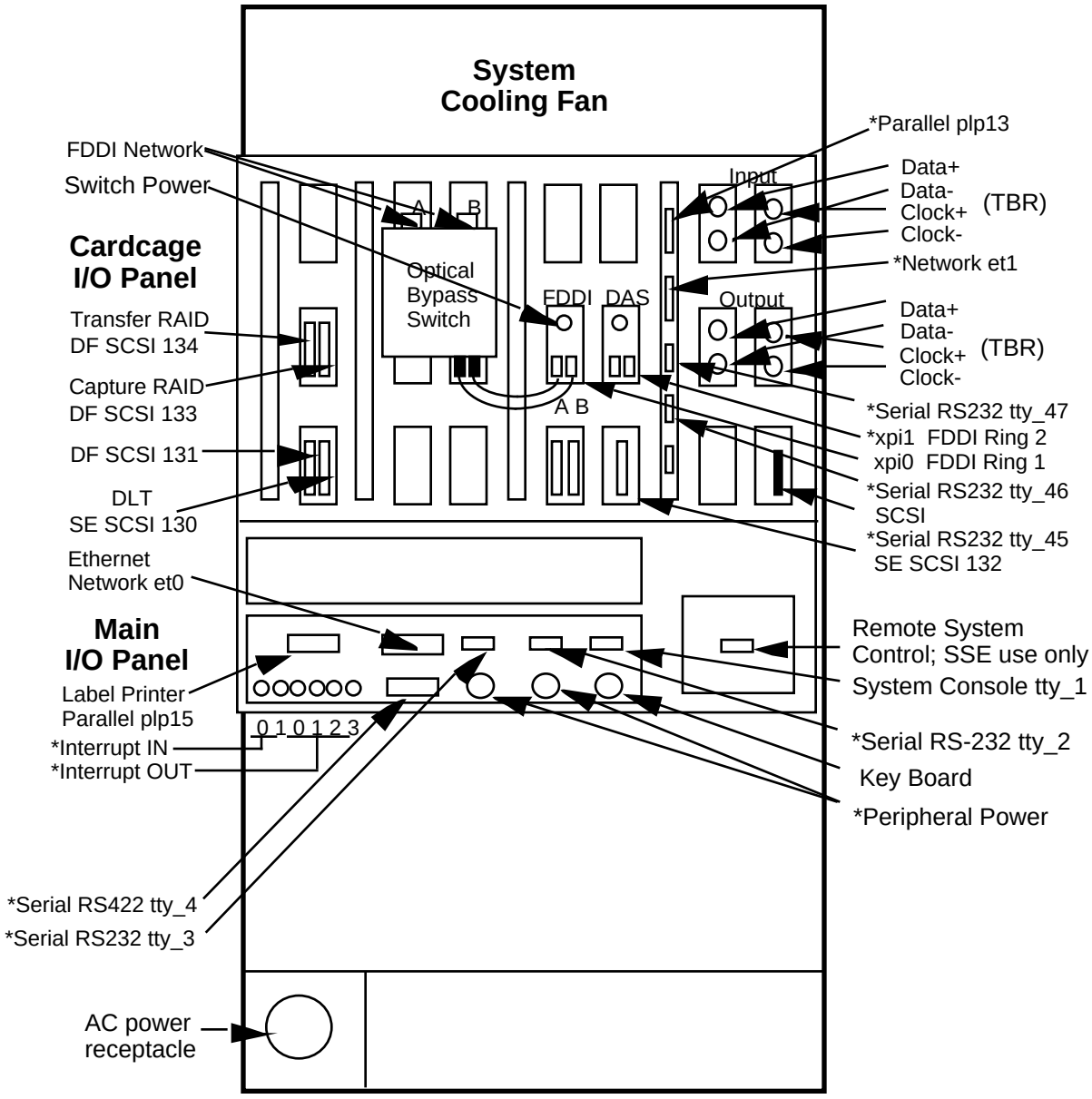


Figure 1-3. Challenge XL (front view with doors open)



* indicates no cable connected to the output port

Figure 1-4. Challenge XL (rear view with doors open)

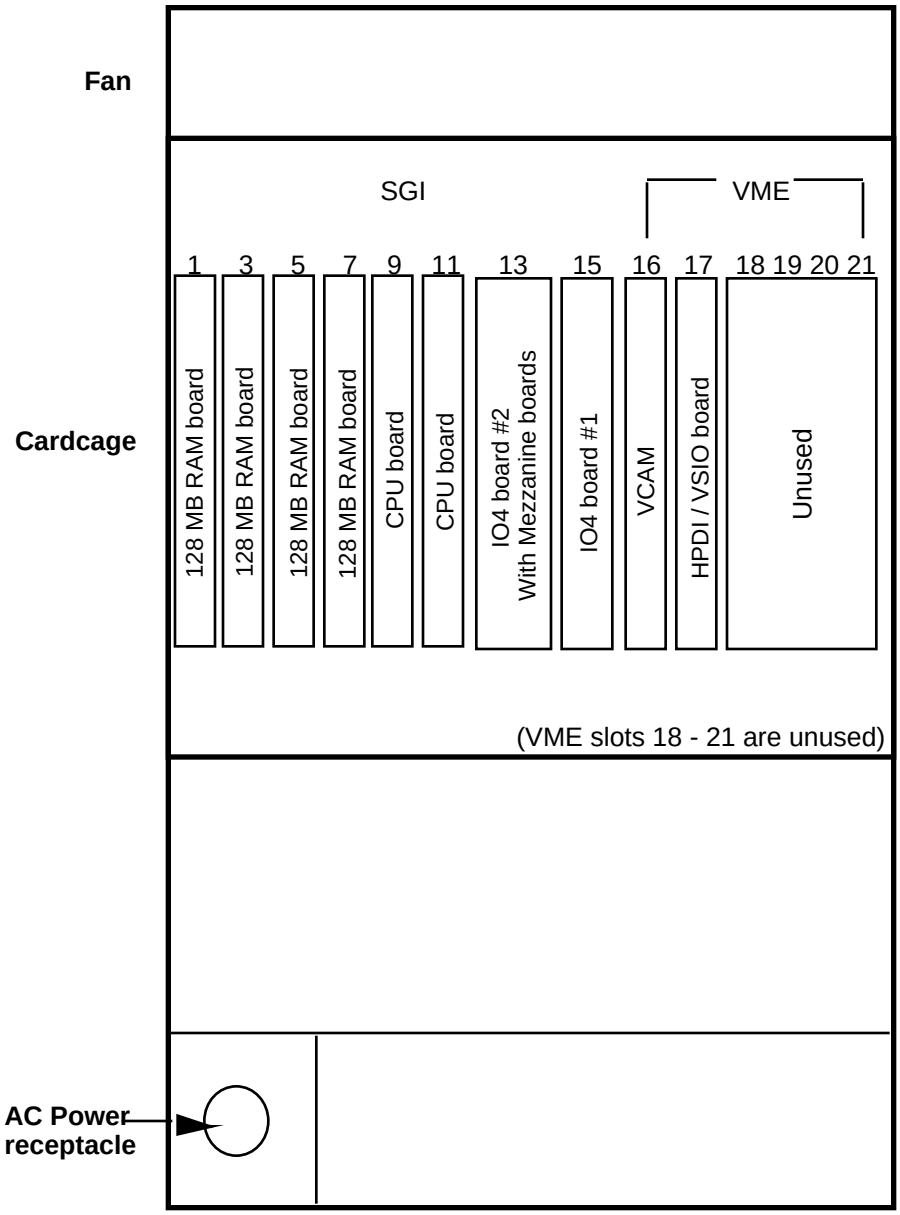


Figure 1-5. Challenge XL (rear view of cardcage)

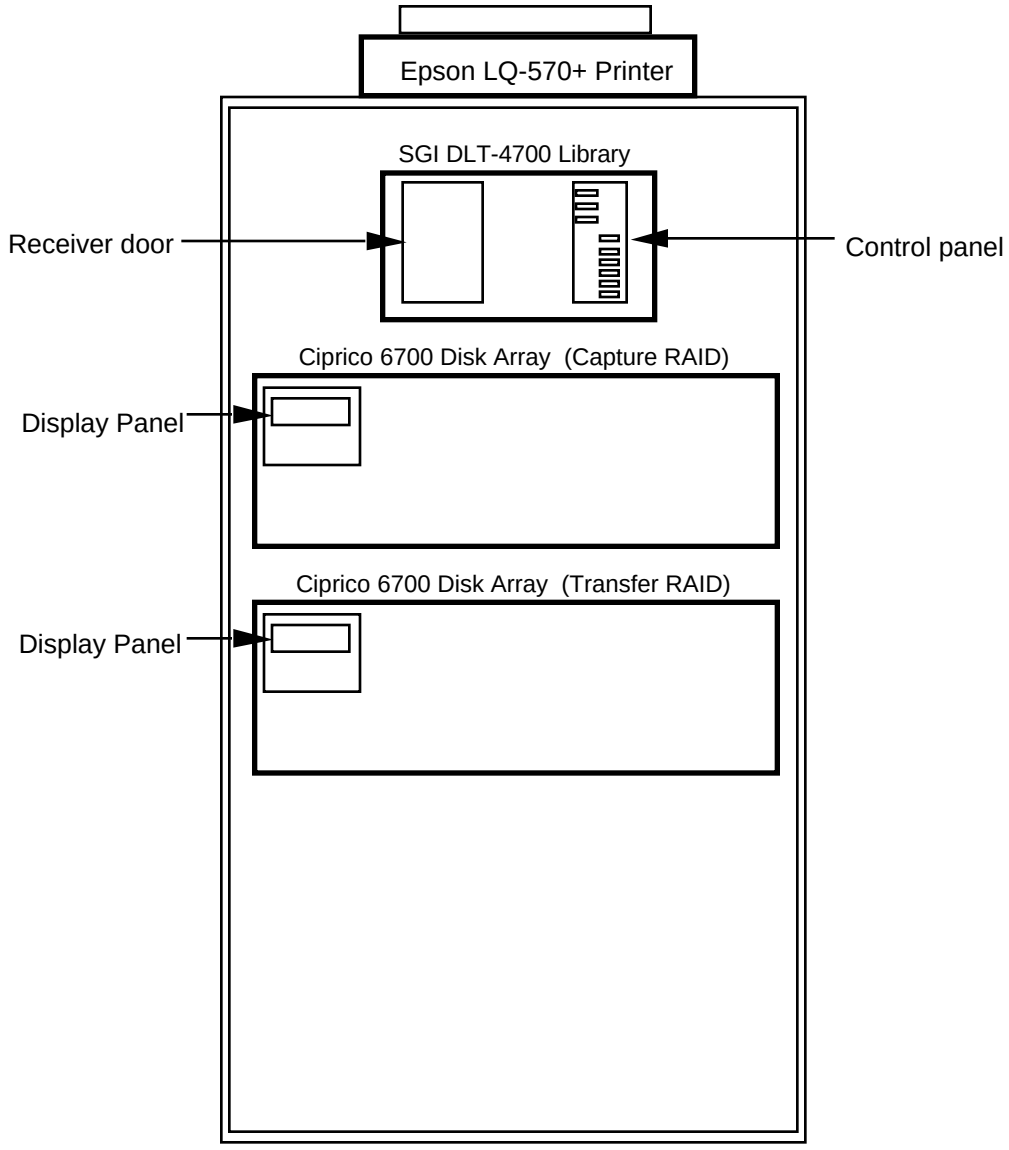


Figure 1-6. RAID/DLT Cabinet (front view)

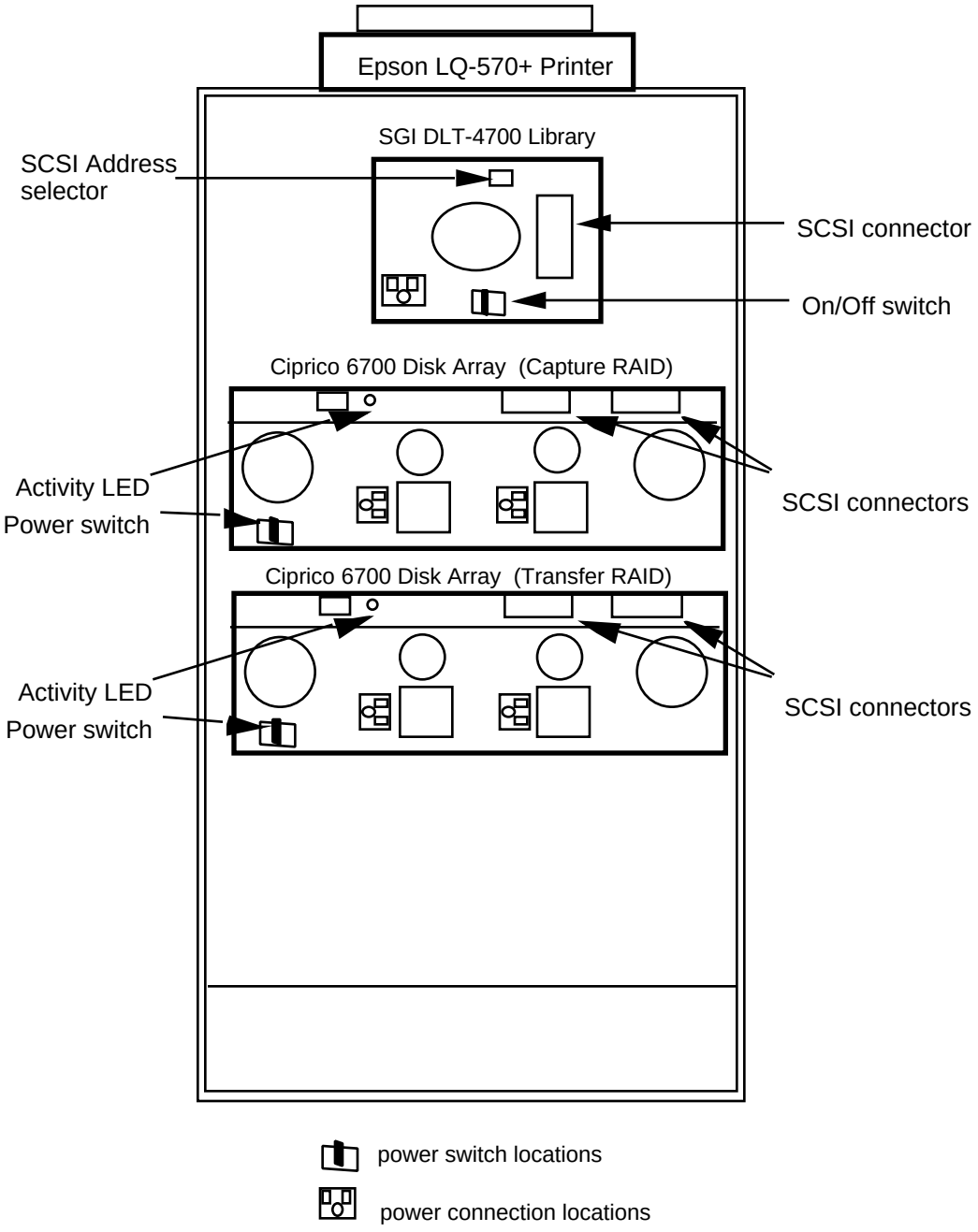


Figure 1-7. RAID/DLT Cabinet (rear view)

A RAID/DLT cabinet is included with each LPS string. Figures 1-6 and 1-7 show the front and rear view of the RAID/DLT cabinet. Each RAID/DLT cabinet contains the following:

A. Two Ciprico, Inc., 6700 disk arrays, Model AR 6702

B. Quantum Corporation DLT 4700 digital linear tape drive

Each LPS string has an Epson letter-quality printer model LQ-570+ The other LPS peripherals are

1. Three Silicon Graphics Incorporated INDY R4600PC workstations

2. Two Network Computing Devices Incorporated X-Terminals (X-terms) consisting of the following:

   A. 21-inch color monitor NC2185AA

   B. HMX system base unit

3. Two HP LaserJet 5 printers

4. One SGI IRISconsole

1.4 Applicable Documents

1. EROS Data Center, *EDC Site Preparation Plan for the Installation of the Landsat 7 LGS. LPS, and IAS*, June 26, 1996.

2. NASA/GSFC, 514-2TP/0195, *LPS Transition Plan*, October 7, 1996

3. —, 514-4BIP/0195, *LPS Build Implementation Plan*, September 1996

4. —, 540-097,*Interface Control Document Between the EBnet and the Landsat 7 Processing System (LPS)*, July 1996

5. —, 209-CD-013-004, *Interface Control Document Between EOSDIS Core System (ECS) and the Landsat 7 System*, August 1996

6. —, 560-1ICD/0794, *Interface Control Document between the Landsat Ground Station and the Landsat Processing System*, Revision 1, September 17, 1996

7. —, 514-4DDS/0195, *Landsat 7 Processing System (LPS) Detailed Design Specification*, November 1995

8. —, 514-2IP/0195, *Landsat 7 Processing System (LPS) Installation Procedure*, Signature, October 14, 1996

9. —, 4560-8SDS/0194,*Landsat 7 Processing System (LPS) System Design Specifications*, May 26, 1995

10. —, 514-3SUG/01, *Landsat 7 Processing System User's Guide*, March 1997

1.5 Vendor Documents

1. Network Computing Devices Inc., Part No. 9300289, *About Your 21-Inch Color Monitor NC2185AA*, Revision A, April 1994

2. —, Part No. 9300326, *Installing Your HMX Family System*, Revision A, February 1995

3. Ciprico Inc., Publication No. 21020270A, *AD6700 Integrated Disk Array Quick Installation Guide*, August 1993

4. —, Publication No. 21020650A, *AD6700/10 Disk Array Guide and Addendum*, March 1994

5. —, Publication No. 21020295 H, *Product Note for 6700/10 Disk Arrays and Controller Boards*, April 1995

6. Silicon Graphics Incorporated, Document No. 108-7040-020, *Challenge/Onyx Site Preparation Guide*, 1993

7. —, Document No. 007-9804-050, *Indy Workstation Owner's Guide*, February 1996

8. —, Document No. 007-1735-040, *Power Challenge™ and Challenge XL Rackmount Owner's Guide*, February 1996

9. —, Document No. 007-2872-001, *IRISconsole Administrator's Guide*

10. Quantum Corporation, Document No. 007-2266-001, *Digital Linear Tape Drive Owner's Guide*, 1994

11. Hewlett-Packard, Publication No. C3916-90901, *LaserJet 5 and 5M Printer User's Manual*

12. IRIS Insight Library, "*Deckside Power Challenge and Challenge L Owner's Guide*" (This online documentation is available on the SGI Challenge L system drive.)

13. General Standard Corporation, *High Speed Parallel Digital Interface (HPDI)/Very High Speed Serial Interface (VSIO) Board User's Manual* **(TBS)**

14. Epson America, Inc., *X-LQ570PLUS, Epson LQ-570+ (Label) Printer User's Guide*

Section 2 — LPS Facility Related Information

This section provides information on floor space, floor loading, power and grounding, heat dissipation, and cabling for the LPS installed at the EDC site. Detailed requirements and design specifications for preparing the LPS installation site are provided in *EDC Site Preparation Plan for the Installation of the Landsat 7 LGS, LPS, and IAS* (Applicable Document 1.4.1).

A detailed list of the LPS hardware components installed at the EDC is provided in Section 5.

2.1 Floor Space

The EDC site floor plan and the computer room layout for LPS is shown in the *EDC Site Preparation Plan for the Installation of the Landsat 7 LGS, LPS, and IAS* (Applicable Document 1.4.1).

SGI specifies a minimum ceiling height of 96 inches to allow for Challenge XL cabinet airflow clearance. Also the Challenge XL cabinet requires 36 inches front and back to allow the doors to open fully. For activities that utilize side access, adequate space is required to roll the cabinet forward or backward to provide side clearance.

2.2 Floor Loading

For installation on raised floors, minimum floor loading is 133 pounds per square foot to support the SGI Challenge XL. The SGI Challenge cabinets use four casters and four stabilizing levelers for weight distribution. If the floor is modified (for example, by adding cutouts for cable access), the EDC has provided the additional reinforcement, as required.

2.3 Power and Grounding

Table 2-1 summarizes the alternating current (ac) power information for the LPS equipment.

Table 2–1. Alternating Current Power Information for LPS Equipment

Equipment	Power VAC (min/nom/max)	Hertz (min/max)	Phase	Amps	Connector Type
Challenge XL	187/208/264	50/60	1	24	NEMA L6-30R) twist-lock type, 2-P, 3-W, 30A, 250V)
RAID/DLT cabinet	100/120	50/60	1	14	NEMA 5-15P (100/120V @ 15 Amps)
Indy workstation - System chassis - Monitor	 100/132 100/132	 47/63 47/63	 1 1	 4.2 2.7	NEMA 5-15P
NCD X-Terminal - Terminal base - Monitor	 90/264 (use 110 nominal) 90/264 (use 110 nominal)	 47/63 50/60	 1 1	 0.2 1.3	NEMA 5-15P
Hewlett-Packard LaserJet5 printer	100/127(+/-10%)	50/60	1	11.2	NEMA 5-15P
Epson LQ 570+ printer	120	50/60	1	2	NEMA 5-15P
IRISconsole	110	50/60	1	1	NEMA 5-15P
Ethernet 10BaseT Smart Hub	110	50/60	1	0.5	NEMA 5-15P

The LPS equipment/racks are grounded as specified in *EDC Site Preparation Plan for the Installation of the Landsat 7 LGS, LPS, and IAS* (Applicable Document 1.4.1). There are no special grounding requirements for the LPS equipment.

2.4 Heat Dissipation

The heat dissipation information on LPS equipment is as follows:

Equipment	No. of Units	ac Load (ton) (each unit/system)	Btu/Hour (each unit/system)
Challenge XL	5	1.33	16,000
Indy	3	0.075	900
DLT	5	0.028	340
RAID	10	0.085	1,020
X-Terminal	2	0.048	570
Printers	2	0.090	1080
LPS Totals (All Units)		**8.141**	**97,900**

The total of 97,900 Btu per hour is required for the LPS, this total is based on five Challenge XL cabinets, three Indy workstations, five RAID/DLT cabinets, and two X terminals.

NOTE: The Challenge cabinet airflow is drawn in through the bottom and blown out through the top. The RAID/DLT cabinet pulls in air from the front and exhausts out the back. The Challenge cabinets and RAID/DLT cabinets are positioned above vented floor tiles.

2.5 Cabling

The cable listing and the interconnection diagrams for the LPS are provided in the Appendices B and C, respectively. The LPS cables including the Indy console cables, printer cables, and LGS coaxial cables are identified by a cable number that cross references to a cable drawing.

Section 3— Operation

This section describes the basic operation of the LPS equipment including startup, login, logout, and shutdown. These procedures are provided to support maintenance activities and the equipment configuration (Section 4). The complete LPS data operations procedures are contained in the *Landsat 7 Processing System User's Guide* (Applicable Document 1.4.10).

3.1 LPS Startup

Apply power to the following LPS equipment:

- Five SGI Challenge XL cabinets—Turn on power at the switch located behind the lower front door (Figure 1-3). Verify that both power supplies have the left amber (ac good) light emitting diodes (LEDs) lit. Insert the key into the lock on the front panel and turn clockwise to 12:00 (ON) position. Verify that the fans start and the front display becomes active and the right green (dc good) LEDs on both power supplies are lit. The system will boot automatically. The XL green power-on LED, located above the function buttons, lights up to indicate that power has been applied to the system midplane. The amber fault LED then lights up to indicate that power has been applied to the system controller. The fault LED goes out when the system controller has successfully initialized and the power-on self-tests (POSTs) are completed.

- Two NCD X-Terminals—Refer to manufacturer's documentation. The monitor power switch is located on the back of the monitor. Verify that the power indicator is green. The power switch for the terminal base unit is located on the rear of the unit. Verify that the power LED is illuminated.

- One SGI IRISconsole—Refer to manufacturer's documentation.

- Three SGI Indy workstations—Refer to manufacturer's documentation. Turn on the monitor power switch on the front of the monitor. Verify that the power indicator is illuminated. On the system chassis, press and release the power switch on the front panel. The power indicator is amber for a few seconds as the system runs the power on diagnostics. The LED turns green as the system boots.

- Five RAID/DLT cabinets (Figures 1-6 and 1-7)—Refer to manufacturer's documentation (Section 1.5). The power switches of the DLTs and RAIDs are located on the rear of the unit.

When the DLTs are powered on, each unit goes through its POST. All of the LEDs on the front of the drive enclosure turn on sequentially from top to bottom as the POST begins. All four LEDs stay on solidly as the POST runs. All LEDs except the yellow tape-in-use LED go dark as the POST finishes. Apply power to the DLTs and verify the POST.

At RAID power up, each RAID performs a built-in self-test (BIST). This process takes approximately 10 seconds. At the conclusion of the process, the display should indicate "On Line Status: OK." Apply power to the RAIDs and verify the BIST.

- Epson LQ-570+ (label) printers—Refer to manufacturer's documentation (Section 1.5.13). Press and release the power switches on the front of the Epson LQ-570+ label printers and verify that the power indicator of each printer is lit.

- Two Hewlett-Packard (HP) LaserJet 5 printers—Refer to manufacturer's documentation (Section 1.5.9). Turn on the power switch on the front of each unit to "I" position. Verify that after the printer warms up, the display reads "READY."

3.2 Login for IRISconsole

After the power up of each Indy , a login window appears. At the prompt, enter name and password on each Indy.

At Indy 3, establish a console window for each LPS string by using the following steps from the IRISconsole utility:

1. Open the Icon Catalog icon from the Overview window.

2. Select the application from the Catalog window.

3. Select the IRISconsole icon on the Icon Catalog Application window.

4. Select an icon that represents string 1 on the IRISconsole window.

5. Select the "Get Console" button on the IRISconsole site window.

6. Enter the system console login ID and password.

7. Apply the selections.

After startup and selection are finished, the prompt "lps001 (or 002 through 005) login:" will appear on each Indy window. Type in the

login and password. At the message “TERM=(vt100)” press <ENTER>.

This completes the login sequence.

3.3 Logout

At each of the Indy workstations, logout can be done by the following steps:

1. Quit from applications
2. Logout from the Challenge XLs by typing "exit" <CR>.
3. Logout from each Indy by choosing "logout" from the Window Manager menu.

This completes the logout sequence.

3.4 LPS Shutdown

To shut down the LPS, perform the following procedure.

1. Five Challenge XL cabinets—At each Indy workstation, log out from all five Challenge XLs. Turn the Challenge XL key switch to OFF.
2. Five Epson LQ-570+ (label) printers—Turn off the power switch on the front of each unit to be powered down.
3. Two HP LaserJet 5 printers—Turn off the power switch on the front of each unit to be powered down.
4. Five RAID/DLT cabinets—Turn off each RAID and DLT within the cabinet. The power switches of the DLTs and RAIDs are located on the rear of each unit.
5. Two NCD X-Terminals—Logout and turn off the monitor power switch located on the back of the monitor. Turn off the power switch for the terminal base unit located on the rear of the unit.
6. Three SGI Indy workstations—Turn off the power switch on the front of the monitor. Turn off the system chassis on the front panel.

7. Five Challenge XL cabinets—Turn off the power switch on the lower right front of the Challenge XL chassis.

This completes the power-down sequence.

Section 4

Software Installation and Hardware Configuration

This section contains information regarding commercial-off-the-shelf (COTS) software installation and the LPS hardware setup. Once these procedures have been implemented, the LPS is functional for data operations. After LPS operation has started, follow software procedures provided in the *LPS Programmer Reference Guide* .

4.1 Software Installation

4.1.1 Challenge XL Operating System

The LPS operational software is installed on each Challenge XL system drive prior to shipment to the EDC. Therefore, LPS operational software installation is not required at the EDC site. However, if for some reason the software is found to be corrupted during LPS installation, the backup (restore) tape can be used to reinstall LPS operational software. The backup/restore tape of the LPS operational software is contained on DLT cartridges.

EDC operation and maintenance personnel are responsible for future IRIX operating system upgrade.

4.1.2 Oracle Data Base Management Software

The Oracle 7™ data base management software is installed on each Challenge XL system prior to shipment to the EDC. Therefore, the Oracle 7™ software installation is not required at the EDC site. If for some reason the software is found to be corrupted during LPS installation, the backup tape can be used to reinstall the Oracle 7™ software. Refer to the *Oracle 7™ Installation and Configuration Guide.*

4.1.3 Hierarchical Data Format (HDF) Library

The current version of hierarchical data format (HDF) software is installed on each Challenge XL system prior to shipment to the EDC. Therefore, the HDF software installation is not required at the EDC site. If for some reason the software is found to be corrupted during LPS installation, the instruction to install and the current version of HDF software can be found via the internet site of the National Center for Supercomputing Applications (NCSA). Using the file transfer protocol (FTP) to download the software files from the NCSA FTP site: ncsa.uiuc.edu.

4.1.4 LPS Level OR Processing Software

The LPS Level OR software is installed on each Challenge XL system prior to shipment to the EDC. If for some reason the software is found to be corrupted during LPS installation, the backup tape can be used to reinstall the LPS Level OR software. Refer to the *LPS Build Plan* document for more details.

4.2 Hardware Setup

4.2.1 Indy Workstation

Refer to Chapter 2 of the *Indy™ Workstation Owner's Guide* (Vendor Documents 1.5.7) for creating a login account and a network connection. After LPS installation, all host names and IP addresses of systems are documented in Appendix D of this O&M manual.

After the power up of each Indy workstation, a login window appears. At the prompt, enter the name and password on each Indy.

Software installation for the Indy workstation is not required.

4.2.2 Digital Linear Tape Drive

The small computer system interface (SCSI) ID of all DLTs are set to 7 prior to shipment to the EDC. Refer to the *Digital Linear Tape Drive Owner's Guide* (Vendor Document 1.5.10) for setting the SCSI ID.

4.2.3 Ciprico Disk Array

The SCSI ID of all Capture RAIDs are set to 6 and the SCSI ID of all Transfer RAIDs are set to 7 prior to shipment to the EDC. Refer to Chapter 2, Section 8 "Configuring the Array," of the *6700/10Disk Array Guide* (Vendor Document 1.5.4) for setting the SCSI ID. Refer to appendix F of this O&M manual for more information on disk partition and xfs file structure of Ciprico 32 GB RAID.

4.2.4 Network Configuration

1. Setting the Ethernet LAN IP addresses.

The Ethernet IP addresses are obtained from the EDC network administrator (refer to Table 1-1 "LPS Installation Responsibilities Matrix" of the *Landsat 7 Processing System Installation Procedure* (Applicable Document 1.4.8)).

2. Setting the FDDI LAN addresses.

The FDDI IP addresses are obtained from the EBnet network administrator (refer to Table 1-1 "LPS Installation Responsibilities Matrix" of the *Landsat 7 Processing System Installation Procedure* (Applicable Document 1.4.8))

Section 5 — Hardware Description

This section describes the LPS hardware components and provides the detailed functional description of the LPS components. The LPS hardware configuration is shown in Figure 1-3.

5.1 SGI Challenge XL

The SGI Challenge XL servers are multi-processor systems designed for distributed computing environments. See Figure 5-1. Their parallel architecture is based on a 1.2 GByte per second sustained bus (E-bus). Each LPS Challenge XL supports eight 250 Mhz R4400 CPUs which are installed on two redundant CPU boards. There are four CPUs on each CPU board. Each CPU has 4 MBytes of secondary cache. The memory subsystem has four RAM boards providing 512 MBytes of memory with four-way interleaving.

As depicted in Figure 5-1, the two IO4 boards and associated mezzanine boards contain the interface for the SGI storage devices, and the RAID/DLT cabinet. The SGI storage devices include a CD-ROM, a 4mm DAT, a 8mm tape, and a 4.3 GByte system disk.

The IO4 board #2 has two mezzanine boards mounted to it with additional controllers to interface to the RAID/DLT cabinet and FDDI network. Additional to the SGI storage devices controllers, the IO4 board #1 also has the controller for the VME/64 backplane, which is internal to the Challenge XL cabinet. The Ethernet LAN controller, along with serial and parallel ports is also located on these IO4 boards.

Figure 5-2 shows the architecture of IO4 board #1. The I-bus connects the various controllers to the E-bus. A single-ended SCSI controller is daisy-chained to the CD-ROM, DAT, and 8mm tape. The 4.3 GB system disk is connected to a differential SCSI controller. The serial tty_1 line and the remote system control line are connected to the SGI IRIS console. The VME bus that is internal to the Challenge cabinet. It contains a COTS General Standards Corporation HPDI/VSIO board. The VCAM board provides the interface between the IO4 board #1 and the VME bus.

Figure 5-3 shows the architecture of IO4 board #2. The I-bus connects the various controllers to the E-bus. A single-ended (S/E) SCSI II controller is used for the digital linear tape (DLT) Drive. The FDDI controller is interfaced to the FDDI network via an optical

bypass switch. The SCSI mezzanine board contains additional SCSI controllers. These additional fast and wide (F/W) differential SCSI II controllers of the mezzanine board are used for the transfer and the capture RAIDs. Each RAID can store up to 32 GBytes of data. The capture RAID is used to store the raw data prior to L0R processing. The transfer RAID stores the processed data prior to transfer to EDC DAAC. The DLT is used for backup or store the raw data for short-term data archiving. The Epson LQ-570PLUS (label) printer is connected to the parallel port. The other controllers are unused.

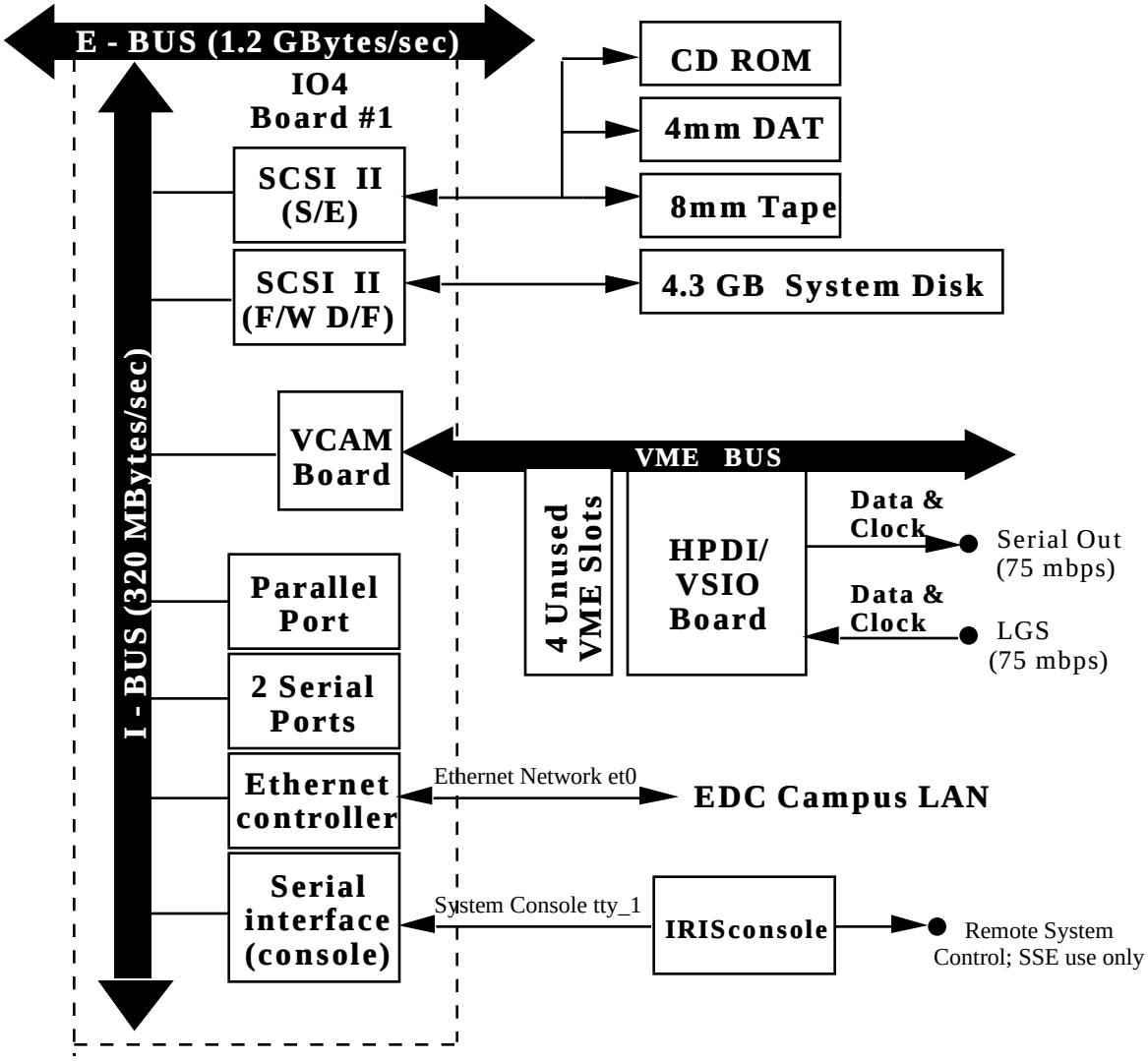


Figure 5-2. IO4 Board #1

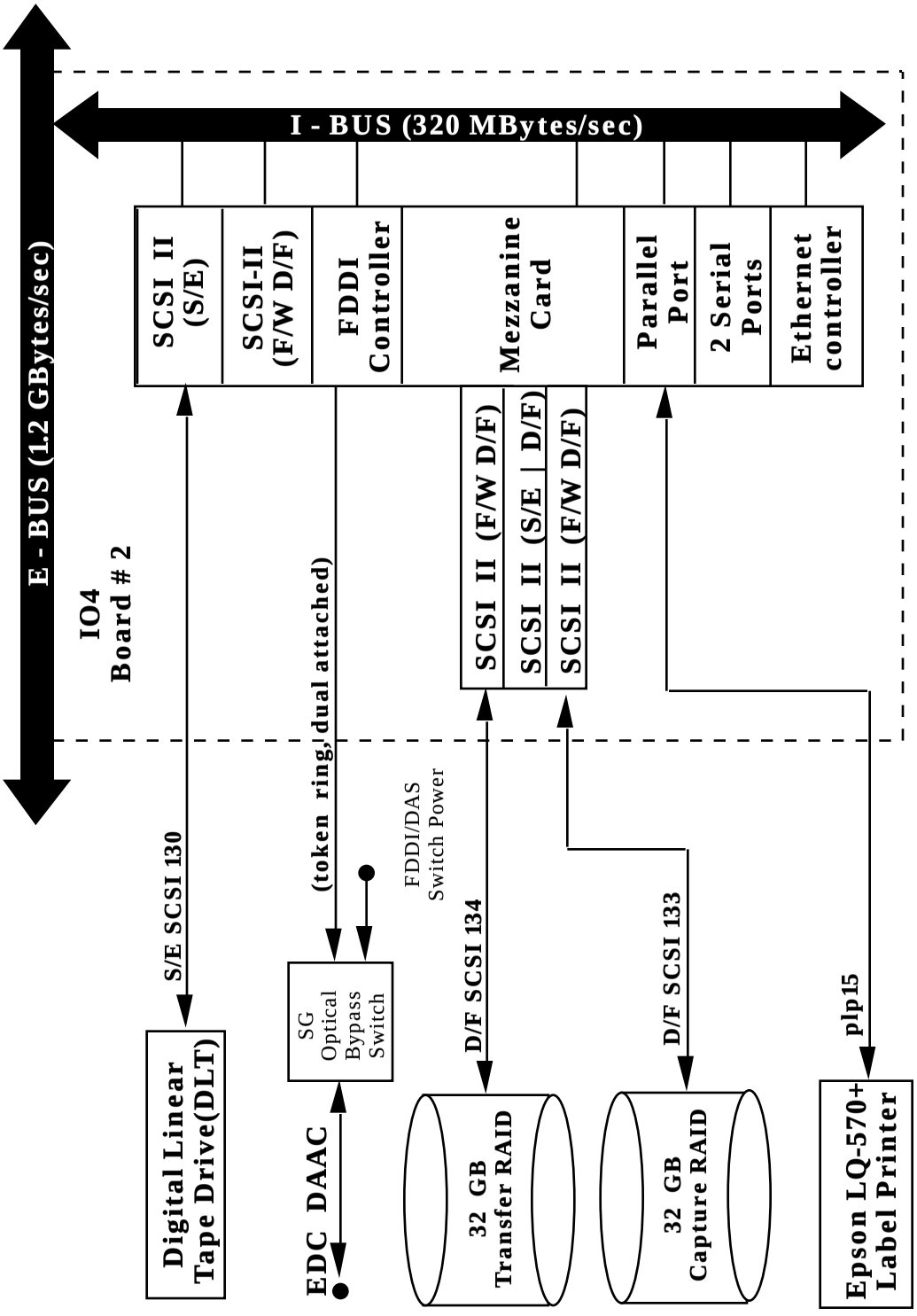


Figure 5-3. IO4 Board #2

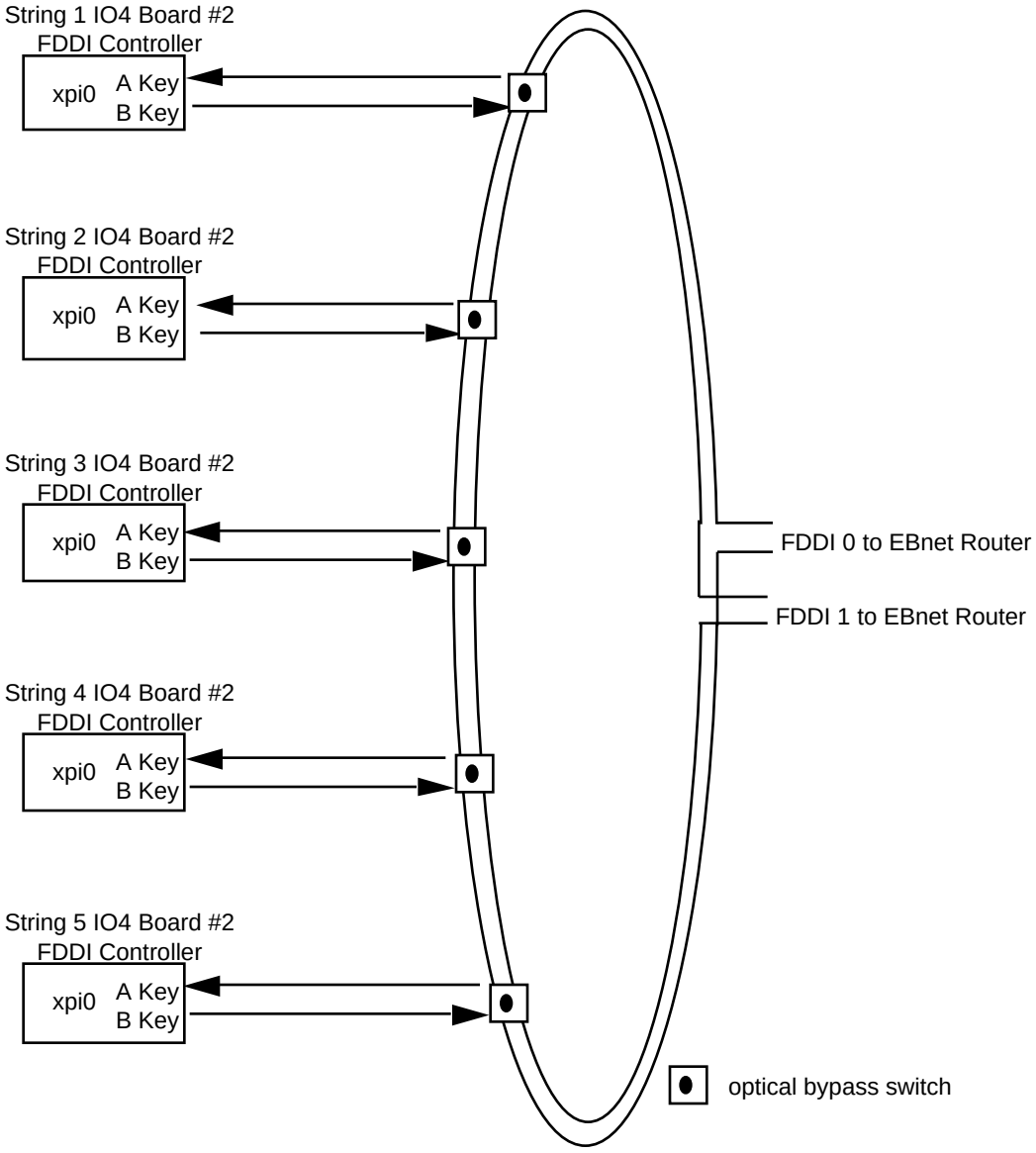


Figure 5-4. FDDI connections

Figure 5-4 details the token ring FDDI LAN connections. The FDDI LAN is dual attached to each Challenge XL for redundancy. The FDDI rings are connected to each Challenge XL's FDDI port (xpi0) via an optical bypass switch. The optical bypass switch is used to allow the FDDI LAN to remain on unaffected if a Challenge XL is disconnected. The FDDI LAN provides the communications path to the EDC DAAC via the EBnet router at EDC.

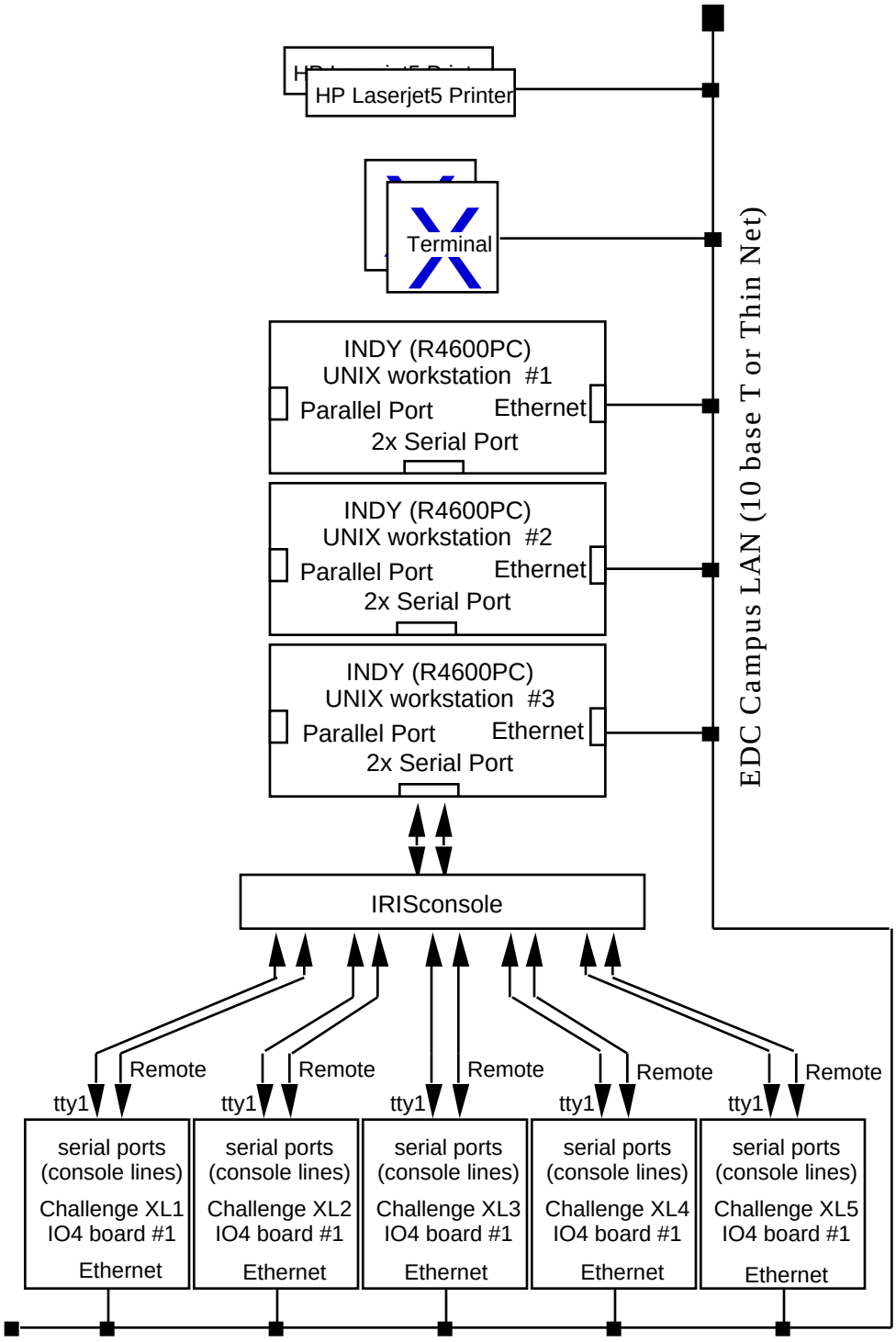


Figure 5-5. Indy, X-Terminal, Ethernet, and Console Line Diagram

Figure 5-5 shows the Ethernet and TTY serial console connections. The console line tty_1 and the remote line from each Challenge XL are connected to the IRISconsole. The IRISconsole is used to select

which of these lines that will communicate with Indy #3. This allows Indy #3 to be used with any Challenge XL. The Ethernet connects the XLs, Indys, X-Terminals and LaserJet printers to each other and also to the EDC Campus LAN. Figure 5-6 shows the rear view of the Ethernet 10 Base T Hub.

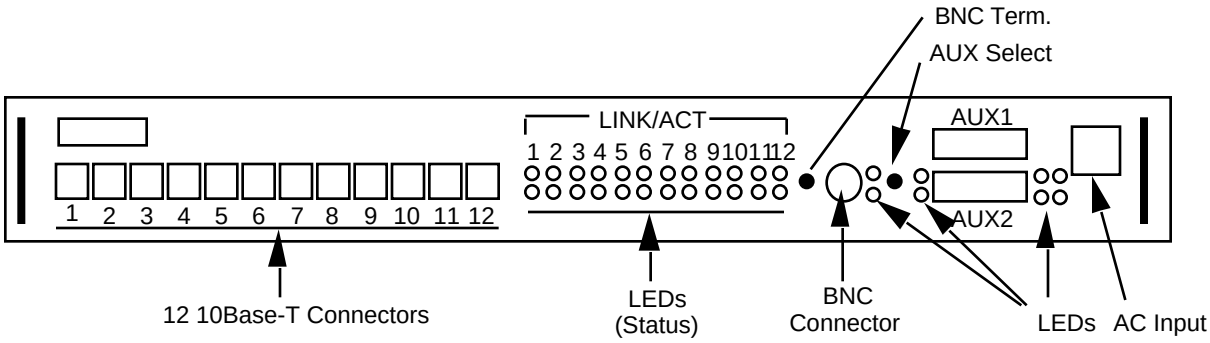


Figure 5-6. Ethernet 10 Base T Hub (rear view)

5.2 Challenge XL VME Bus

The Challenge XL cabinet has an internal VME bus containing the COTS General Standards Corporation High Speed Parallel Digital Interface (HPDI)/Very high Speed Serial Interface (VSIO) board. This board is used to receive serial raw wideband data from LGS and transmit test data to LGS.

5.2.1 General Standards Corporation HPDI/VSIO Board

The High Speed Parallel Digital Interface (HPDI)/Very high Speed Serial Interface (VSIO) board is a standard 9U VMEbus COTS product. The HPDI/VSIO board is designed by General Standards Corporation. It provides a very high-speed serial data interface, a high-speed data conversion from serial-to-parallel and parallel-to-serial, and a very high-speed parallel digital interface to VMEbus.

The HPDI/VSIO board has two serial input and output channels. Each channel has separate clock and data. Differential ECL is used for serial signals interfacing; therefore, four interface signals are required for each channel (Data+, Data-, Clock+ and Clock-). The HPDI/VSIO board can receive or transmit a continuous serial data stream at speed of 75 Mbits per second.

The HPDI/VSIO board also has a data conversion logic which is used to convert data in realtime from serial-to-parallel or from parallel-to-serial. The data conversion logic is interfaced to a very high-speed parallel digital interface for high-speed transmission/reception of parallel digital data. This parallel digital interface logic supports data transfers over VMEbus (at rates up to 55 MBytes per second) and provides two banks of static RAM to allow for continuous high-speed noninterrupted transfer of data.

In general, the HPDI/VSIO board is designed specially to receive or transmit a continuous serial stream of high-speed data. It provides data conversion and interfacing to SGI Challenge via VMEbus and VCAM. Refer to *General Standards Corporation VSIO manual addendum to HPDI manual, rev. 003, July 17 1996* and *VME-HPDI Users Manual, Oct. 25, 1995* for more details information of the HPDI/VSIO board.

5.3 RAID/DLT Cabinet

The RAID/DLT cabinet contains two Ciprico disk arrays (RAIDs), and one DLT 4700 drive.

5.3.1 Ciprico Disk Array (RAID)

Two Ciprico Inc. 6700 disk array subsystems, each referred to as a RAID, is included with each LPS string. These disk arrays are connected to the SGI Challenge XL via a SCSI-2 differential fast/wide controller. The disk array contains eight 3.5-inch disk drives in parallel along with a ninth (parity) drive providing more than 32 GBytes (formatted) of data storage. The 32 GByte storage capacity will allow the capture (data receipt and transfer to disk) of about 56 minutes of continuous data at the Landsat 7 data rate of 75 Mbits/second. The disk array subsystem contains redundant power supplies.

5.3.2 DLT Drive

A DLT 4700 drive is included to each string of the LPS. The DLT 4700 is interfaced to the Challenge XL via an SCSI-2 single-end controller port. The DLT 4700 is a mini-library storage system with seven-cartridge (0.5-inch) library subsystems. It is primary used to store capture raw wideband data.

Each DLT 4700 incorporates an elevator mechanism that provides direct or sequential cartridge access between the tape drive and cartridge magazine. The magazine loading feature allows up to seven cartridges to be managed as a complete set. The formatted capacities of 280 GB for each DLT 4700 and with sustained data transfer rate is 3.0 MB per second (peak transfer rate of 10 MBytes per second).

5.4 Peripherals

LPS peripherals include three Silicon Graphics Inc. Indy R4600PC workstations. These Indy workstations are provided for operator interface and the Moving Window Display. Two HP LaserJet5 printers are connected to Ethernet LAN. There are two Network Computing Devices Inc. terminals (X-terms) that can be used by all five strings via Ethernet. Each string includes an Epson LQ-570+ (label) printer to generate DLT cassette labels.

5.5 Hardware Functional Description

The following subsections describe the detailed functional description of LPS.

5.5.1 Data Capture

A Data Capture Flow Diagram is shown in Figure 5-7. Serial emitter-coupled-logic (ECL) data and clock are received by an LPS string HPDI/VSIO board. The HPDI/VSIO board is designed to receive serial data (raw ETM+ wideband data) from the LGS matrix switch at real-time rate of 75 Mbits/second, and convert serial data to parallel data. After the conversion, the data are then moved from the HPDI/VSIO board into SGI system RAM across the VCAM VME-bus, the IO4 board #1 I-bus, and the SGI system E-bus. The peak transfer rates of the E-bus, the I-bus and the VME-bus are specified as 1.2 GBytes per second, 320 MBytes per second, and 40 MBytes per second, respectively. From SGI system RAM, where the data are memory mapped to a file, it is transferred to the data capture RAID via IO4 board #2 SCSI-2 controller which has a peak transfer rate of 20 MBytes per second.

Special device driver software was written especially for the HPDI/VSIO board. This device driver facilitates the capture and

playing back of raw ETM+ wideband data by the LPS strings. It works by establishing two memory buffer buckets, through DMA procedures and low level interrupts. It loads the raw ETM+ wideband data into memory with almost no intervention of the system's eight CPUs.

5.5.2 Data Storage

Once the capture of data is completed, the data are stored on DLT 4700. Figure 5-8 is shown Data Store Flow Diagram from Capture RAID to DLT 4700. The data are transferred from Capture RAID to DLT 4700 via SCSI ports of IO4 board #2 and SGI system RAM. A DLT 4700 has a sustained transfer rate of 3 MBytes per second and a peak transfer rate of 10 MBytes per second. Each cartridge of DLT 4700 is stored up to 40 GBytes (assumes 2:1 data compression) of data. A DLT 4700 library has seven cartridges, which provide the storage capacity up to 280 GBytes (assumes 2:1 data compression) of data.

5.5.3 Data Processing

A data processing flow diagram is shown in Figure 5-9. The wideband data, which are stored on Capture RAID is processed by SGI Challenge XL to generate Level OR data format. The Level OR data are temporary stored on transfer RAID before transferring to EDC DAAC.

As shown in Figure 5-9, the wideband data from Capture RAID is transferred to SGI Challenge XL processors via a SCSI-2 port on the mezzanine board of IO4 board #2 and the SGI Challenge XL E-bus. During the processing, the Level OR data output is transferred to Transfer RAID via another SCSI-2 port on the mezzanine board of IO4 board #2 and the SGI Challenge XL E-bus.

The serial data output flow is the reverse of Figure 5-7 and similarly the playback of data from the DLT to the RAID is the reverse of Figure 5-8.

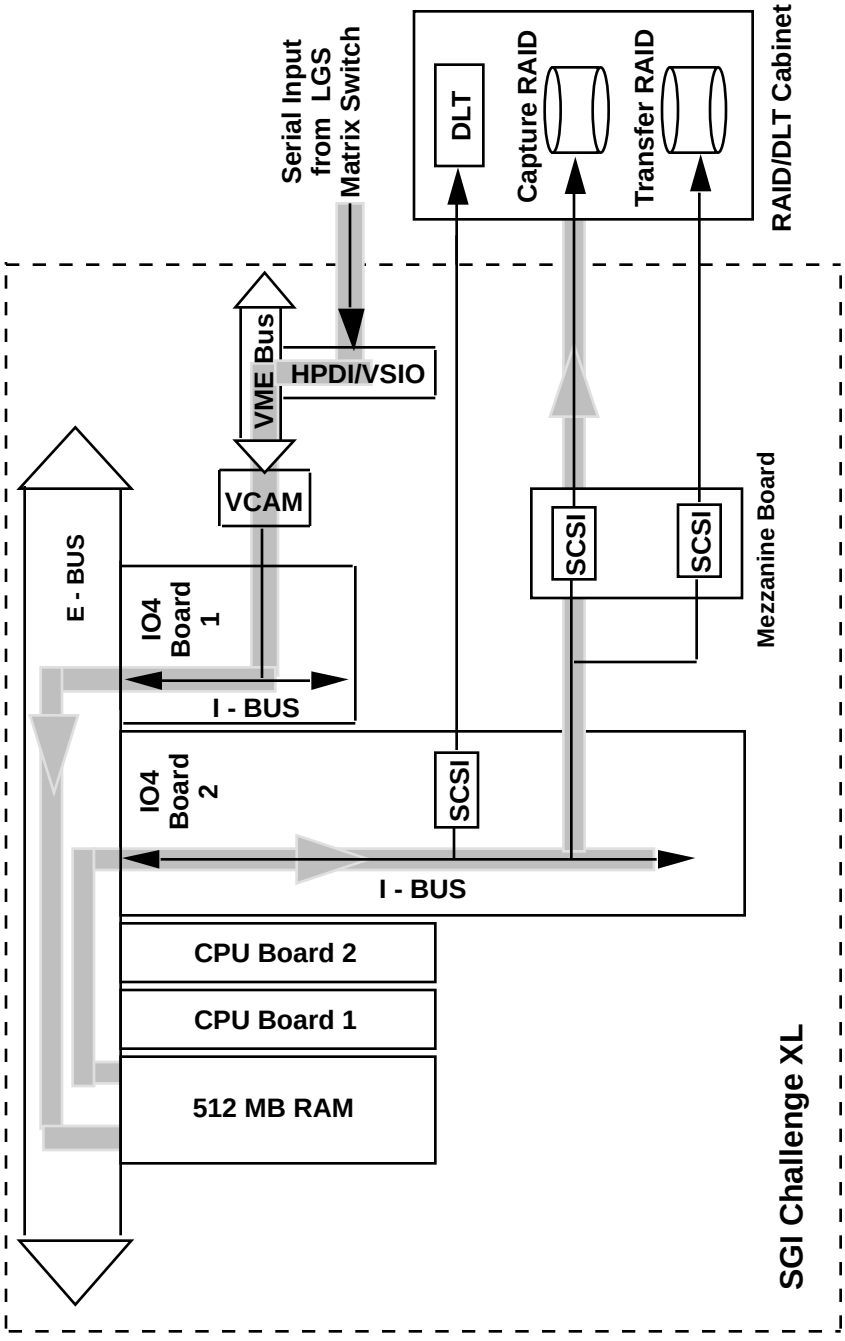


Figure 5-7. Data Capture Flow Diagram

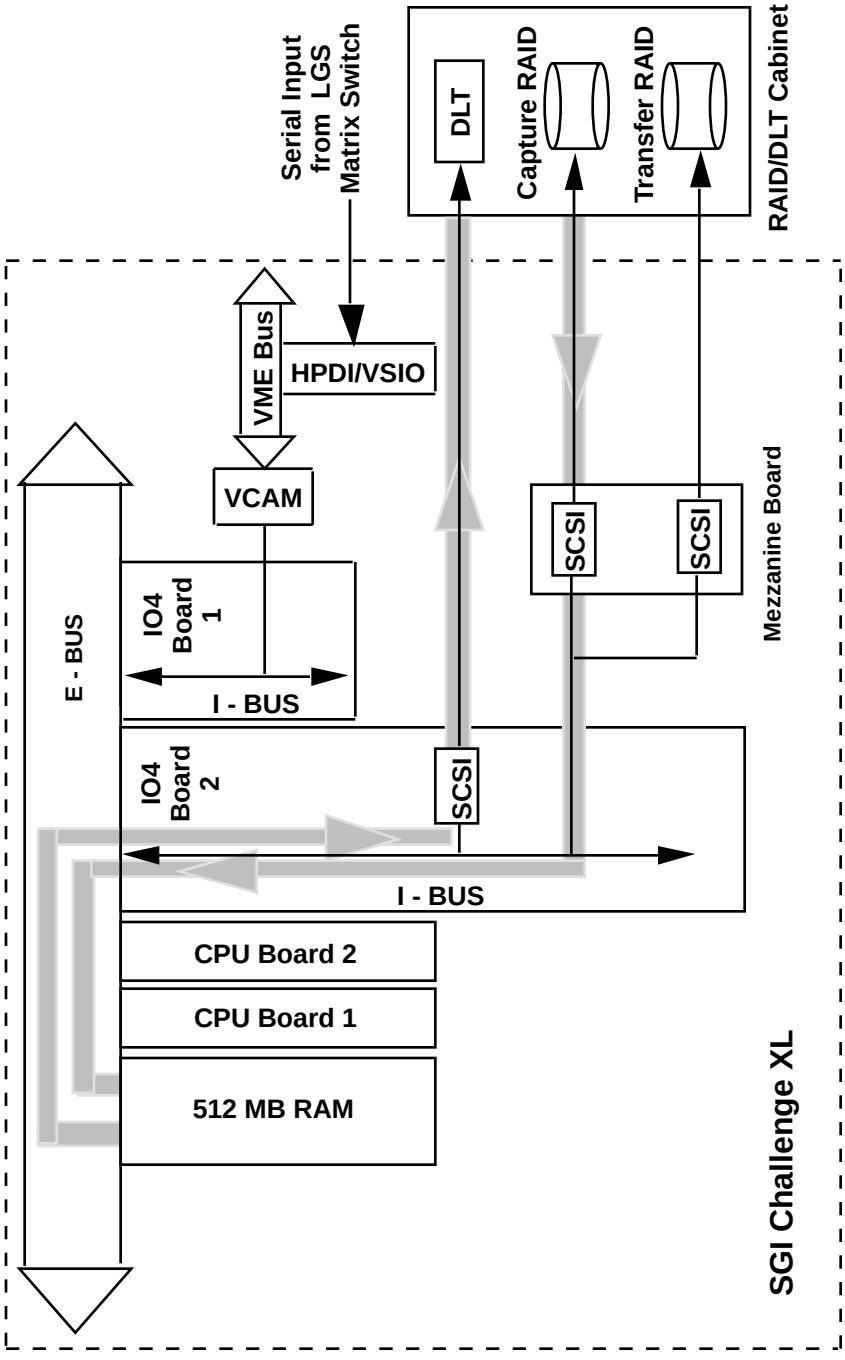


Figure 5-8. Data Store Flow Diagram

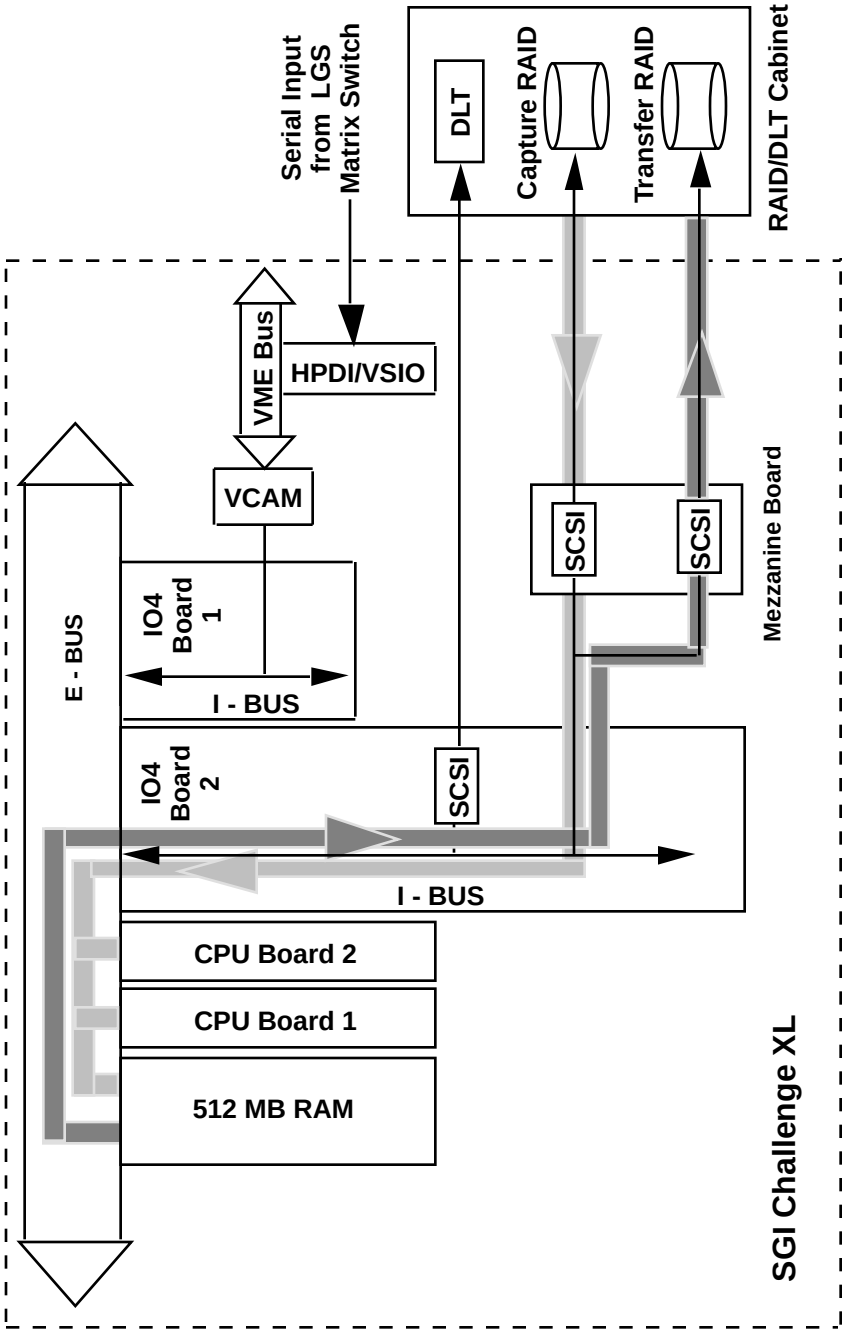


Figure 5-9. Data Processing Flow Diagram

Section 6 — Maintenance

This section provides preventative and corrective maintenance information for the LPS. The information includes instructions for cleaning, troubleshooting, and repairing LPS components.

6.1 Preventative Maintenance

Refer to Appendix E for preventative maintenance schedule.

6.1.1 SGI Challenge XL

The SGI documentation contains preventative maintenance information. Refer to the *SGI Power Challenge XL Rackmount Owner's Guide* (Vendor Document 1.5.8), Appendix B for information on the following:

1. Cleaning the 4mm DAT and 8mm tape drives
2. CD-ROM maintenance

6.1.2 Ciprico Disk Array

Refer to the Ciprico *AD6700/10 Disk Array Guide and Addendum* (Vendor Document 1.5.4) Chapter 6 for instructions on the following:

1. Cleaning the air filter
2. Verifying cooling fan operation
3. Verifying power supply fan operation

6.1.3 Quantum DLT Drive

Refer to Chapter 5 of the Quantum *Digital Linear Tape Drive Owner's Guide* (Vendor Document 1.5.10) for cleaning and maintenance information.

6.1.4 SGI Indy Workstation

The workstation does not require routine maintenance because drives are not provided with the workstation. Power-on self-tests are run automatically. Follow the "Hardware and Software Do's and Don'ts" described in Chapter 9, "Safety, Maintenance and Regulatory Information" of the *Indy Workstation Owner's Guide* (Vendor Document 1.5.7)

6.1.5 NCD Terminal

Refer to the document *About Your 21-Inch Color Monitor NC2185AA* (Vendor Document 1.5.1) for monitor care and adjustments to be performed as needed.

6.1.6 HP LaserJet 5 Printer

Refer to the Hewlett-Packard *Laserjet 5 and 5M Printer User's Manual* (Vendor Document 1.5.11) Chapter 8 for maintenance and adjustment of the printer.

6.1.7 Epson LQ-570+ (Lable) Printer

Refer to the *Epson LQ-570+ User's Guide* (Vendor Document 1.5.14), Chapter 5, pages 5-2 and 5-3 for cleaning the printer and replacing the ribbon, respectively.

6.2 Corrective Maintenance

6.2.1 SGI Challenge XL

SGI field service is contracted to maintain the Challenge XL. The SGI documentation contains corrective maintenance information that is useful to EDC maintenance personnel. Refer to following

sections of the SGI *Power Challenge and Challenge XL Rackmount Owner's Guide* (Vendor Document 1.5.8):

1. Chapter 5, "Having Trouble," can be used to diagnose system faults.
2. Chapter 4 contains information on installing peripherals.
3. Appendix D discusses PROM and mezzanine troubleshooting.

If the Challenge XL system disk has been replaced, refer to Section 4 of this document for installing the LPS operating system software, and hardware setup. The operating system will be installed by SGI field service.

6.2.2 Ciprico Disk Array

Refer to the Ciprico *AD6700/10 Disk Array Guide and Addendum* (Vendor Document 1.5.4), Chapters 4 and 5 for instructions on the following:

1. Drive failures and rebuild
2. Replacing a failed power supply

Failures are reported through the display panel and the audio alarm (if enabled).

The display panel operation is described in Chapter 3 of the *Ciprico AD6700/10Disk Array Guide and Addendum* (Vendor Document 1.5.4). A BIST is performed on powerup. The self test codes are described in Chapter 3 (Troubleshooting) of the *AD6700 Integrated Disk Array Quick installation Guide* (Vendor Document 1.5.3).

6.2.3 Quantum Digital Linear Tape Drive

Refer to Chapter 5 of the Quantum *Digital Linear Tape Drive Owner's Guide* (Vendor Document 1.5.10) for troubleshooting information and possible solutions to potential problems.

6.2.4 SGI Indy Workstation

Refer to the *Indy Workstation Owner's Guide* (Vendor Document 1.5.7). Chapter 7 "Troubleshooting" provides information on installing and removing hardware and software components. Other

information is included that is useful for diagnosing problems and identifying faults.

6.2.5 NCD Terminal

Refer to the documents *About Your 21-Inch Color Monitor NC2185AA* (Vendor Document 1.5.1) and *Installing Your HMX Family System* (Vendor Document 1.5.2) for troubleshooting information and obtaining technical support.

6.2.6 HP LaserJet 5 Printer

Refer to Chapter 7 of the Hewlett-Packard *LaserJet 5 and 5M Printer User's Manual* (Vendor Document 1.5.11) for detail information on how to solve the printer problems.

6.2.7 Epson LQ-570+ (Label) Printer

Refer to the *Epson LQ-570+ User's Guide* (Vendor Document 1.5.14). Chapter 6 "Troubleshooting" provides information on power supply, printing and paper-handling problems. Other information about the technical specifications and command summary can also be found in Chapter 7 and Chapter 8, respectively.

Appendix A—LPS Parts List

System Name	Manufacture	Part No.
Challenge XL System		
Challenge XL Rackmount	Silicon Graphics Inc.	R-49808-S4
128MB RAM Board	Silicon Graphics Inc.	H4-128-MEMSYS-2
CPU Board	Silicon Graphics Inc.	030-0804-101
IO4 Board w/o mezzanine	Silicon Graphics Inc.	HU-PC2
SCSI Mezzanine Board	Silicon Graphics Inc.	P-S-HIO SCSI
4.3 GB System Disk	Silicon Graphics Inc.	013-1512-001
Compact Disk (CD-ROM)	Silicon Graphics Inc.	P8-CDROM-4X
4mm Digital Audio Tape (DAT) Drive	Silicon Graphics Inc.	P8-S-00S2
8mm Tape Drive	Silicon Graphics Inc.	P8-S-8MM
FDDI	Silicon Graphics Inc.	C8-FDDIXPH
Optical Bypass Switch	Silicon Graphics Inc.	**TBS**
HPDI/VSIO Board	General Standard Corporation	VME-VSIO-1
IRISconsole	Silicon Graphics Inc.	C0-IRISCONSOLE
Indy Workstation		
System	Silicon Graphics Inc.	W8A1-5032
Monitor	Silicon Graphics Inc.	GMD20D11
Digital Linear Tape 4700	Quantum Corporation	TH5EA-YF
6700 Disk Arrays, Model AR 6702	Ciprico Inc	AS6714-3A
Epson LQ-570PLUS printer	Epson America Inc.	555-374
HP LaserJet 5 printer	Hewlett-Packard	C3916A#ABA
X-Terminal		
21 Inch Color Monitor NC2185AA	Network Computing Devices Inc.	NC2185-AA
HMX System	Network Computing Devices Inc.	NCD-HMX
Ethernet 10 Base-T Smart Hub, Model ENT-4392	LANCAST Standard Hierarchical Networks	ENT-4392-1

Appendix B—LPS Interconnection Cable List (TBR)

Ref. No.	From	To
Interconnection cable between Challenge XL and RAIDs		
001	LPS001_DF SCSI 134	LPS001_Transfer RAID
002	LPS002_DF SCSI 134	LPS002_Transfer RAID
003	LPS003_DF SCSI 134	LPS003_Transfer RAID
004	LPS004_DF SCSI 134	LPS004_Transfer RAID
005	LPS005_DF SCSI 134	LPS005_Transfer RAID
006	LPS001_DF SCSI 133	LPS001_Capture RAID
007	LPS002_DF SCSI 133	LPS002_Capture RAID
008	LPS003_DF SCSI 133	LPS003_Capture RAID
009	LPS004_DF SCSI 133	LPS004_Capture RAID
010	LPS005_DF SCSI 133	LPS005_Capture RAID
Interconnection cable between Challenge XLs and DLTs		
011	LPS001_SE SCSI 130	LPS001_DLT4700
012	LPS002_SE SCSI 130	LPS002_DLT4700
013	LPS003_SE SCSI 130	LPS003_DLT4700
014	LPS004_SE SCSI 130	LPS004_DLT4700
015	LPS005_SE SCSI 130	LPS005_DLT4700
Interconnection cable between Challenge XLs and Epson LQ-570+ (Label Printers)		
016	LPS001_Parallel Port_plp15	LPS001_Label Printer
017	LPS002_Parallel Port_plp15	LPS002_Label Printer
018	LPS003_Parallel Port_plp15	LPS003_Label Printer
019	LPS004_Parallel Port_plp15	LPS004_Label Printer
020	LPS005_Parallel Port_plp15	LPS005_Label Printer
Interconnection cable between Ethernet 10Base-T Hub and Systems		
021	LANCAST_10Base-T Port 1	LPS001_Ethernet Network_et0
022	LANCAST_10Base-T Port 2	LPS002_Ethernet Network_et0
023	LANCAST_10Base-T Port 3	LPS003_Ethernet Network_et0
024	LANCAST_10Base-T Port 4	LPS004_Ethernet Network_et0
025	LANCAST_10Base-T Port 5	LPS005_Ethernet Network_et0
026	LANCAST_10Base-T Port 6	X-Terminal 1_Ethernet Port
027	LANCAST_10Base-T Port 7	X-Terminal 2_Ethernet Port
028	LANCAST_10Base-T Port 8	Indy W/S 1_Ethernet Port
029	LANCAST_10Base-T Port 9	Indy W/S 2_Ethernet Port
030	LANCAST_10Base-T Port 10	Indy W/S 3_Ethernet Port
031	LANCAST_10Base-T Port 11	HP LaserJet 5 Printer 1
032	LANCAST_10Base-T Port 12	HP LaserJet 5 Printer 2
033	LANCAST_BNC Port	EDC Exchange LAN

Ref. No.	From	To
Interconnection cable between FDDI Ring and Systems		
034	LPS001_FDDI_Ch.A	LPS002_FDDI_Ch.B
035	LPS002_FDDI_Ch.A	LPS003_FDDI_Ch.B
036	LPS003_FDDI_Ch.A	LPS004_FDDI_Ch.B
037	LPS004_FDDI_Ch.A	LPS005_FDDI_Ch.B
038	LPS005_FDDI_Ch.A	EBnet_E7513_Ch.B
039	EBnet_E7513_Ch.A	EBnet_E4700_Ch.B
040	EBnet_E4700_Ch.A	LPS001_FDDI_Ch.B
Interconnection cable between IRISconsole and Systems		
041	IRISconsole_SCSI Port	Indy W/S 3_SCSI Port
042	IRISconsole_Port 1	LPS001_System Console tty_1
043	IRISconsole_Port 2	LPS001_Remote System Console
044	IRISconsole_Port 3	LPS002_System Console tty_1
045	IRISconsole_Port 4	LPS002_Remote System Console
046	IRISconsole_Port 5	LPS003_System Console tty_1
047	IRISconsole_Port 6	LPS003_Remote System Console
048	IRISconsole_Port 7	LPS004_System Console tty_1
049	IRISconsole_Port 8	LPS004_Remote System Console
050	IRISconsole_Port 9	LPS005_System Console tty_1
051	IRISconsole_Port 10	LPS005_Remote System Console
Interconnection cable between Challege XLs and LGS Matrix Switch		
052	LPS001_Data+_Out	LGS MatrixSwitch_Port0_Data+_In
053	LPS001_Data-_Out	LGS MatrixSwitch_Port0_Data-_In
054	LPS001_Clock+_Out	LGS MatrixSwitch_Port0_Clock+_In
055	LPS001_Clock-_Out	LGS MatrixSwitch_Port0_Clock-_In
056	LPS001_Data+_In	LGS MatrixSwitch_Port0_Data+_Out
057	LPS001_Data-_In	LGS MatrixSwitch_Port0_Data-_Out
058	LPS001_Clock+_In	LGS MatrixSwitch_Port0_Clock+_Out
059	LPS001_Clock-_In	LGS MatrixSwitch_Port0_Clock-_Out
060	LPS002_Data+_Out	LGS MatrixSwitch_Port1_Data+_In
061	LPS002_Data-_Out	LGS MatrixSwitch_Port1_Data-_In
062	LPS002_Clock+_Out	LGS MatrixSwitch_Port1_Clock+_In
063	LPS002_Clock-_Out	LGS MatrixSwitch_Port1_Clock-_In
064	LPS002_Data+_In	LGS MatrixSwitch_Port1_Data+_Out
065	LPS002_Data-_In	LGS MatrixSwitch_Port1_Data-_Out
066	LPS002_Clock+_In	LGS MatrixSwitch_Port1_Clock+_Out
067	LPS002_Clock-_In	LGS MatrixSwitch_Port1_Clock-_Out

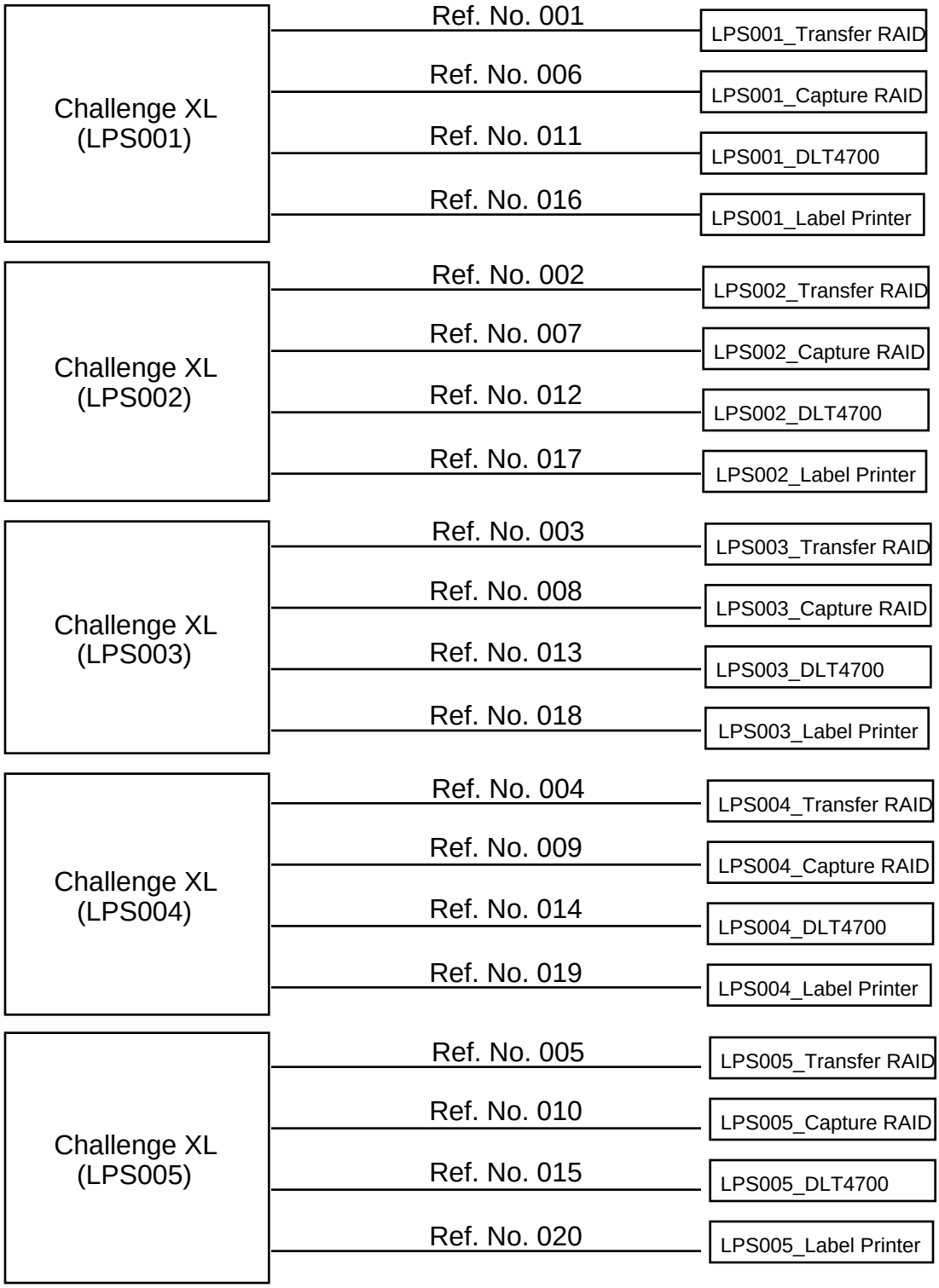
Ref. No.	From	To
068	LPS003_Data+_Out	LGS MatrixSwitch_Port2_Data+_In
069	LPS003_Data-_Out	LGS MatrixSwitch_Port2_Data-_In
070	LPS003_Clock+_Out	LGS MatrixSwitch_Port2_Clock+_In
071	LPS003_Clock-_Out	LGS MatrixSwitch_Port2_Clock-_In
072	LPS003_Data+_In	LGS MatrixSwitch_Port2_Data+_Out
073	LPS003_Data-_In	LGS MatrixSwitch_Port2_Data-_Out
074	LPS003_Clock+_In	LGS MatrixSwitch_Port2_Clock+_Out
075	LPS003_Clock-_In	LGS MatrixSwitch_Port2_Clock-_Out
076	LPS004_Data+_Out	LGS MatrixSwitch_Port3_Data+_In
077	LPS004_Data-_Out	LGS MatrixSwitch_Port3_Data-_In
078	LPS004_Clock+_Out	LGS MatrixSwitch_Port3_Clock+_In
079	LPS004_Clock-_Out	LGS MatrixSwitch_Port3_Clock-_In
080	LPS004_Data+_In	LGS MatrixSwitch_Port3_Data+_Out
081	LPS004_Data-_In	LGS MatrixSwitch_Port3_Data-_Out
082	LPS004_Clock+_In	LGS MatrixSwitch_Port3_Clock+_Out
083	LPS004_Clock-_In	LGS MatrixSwitch_Port3_Clock-_Out
084	LPS005_Data+_Out	LGS MatrixSwitch_Port4_Data+_In
085	LPS005_Data-_Out	LGS MatrixSwitch_Port4_Data-_In
086	LPS005_Clock+_Out	LGS MatrixSwitch_Port4_Clock+_In
087	LPS005_Clock-_Out	LGS MatrixSwitch_Port4_Clock-_In
088	LPS005_Data+_In	LGS MatrixSwitch_Port4_Data+_Out
089	LPS005_Data-_In	LGS MatrixSwitch_Port4_Data-_Out
090	LPS005_Clock+_In	LGS MatrixSwitch_Port4_Clock+_Out
091	LPS005_Clock-_Out	LGS MatrixSwitch_Port4_Clock-_Out

* **Cable Labeling Scheme:**

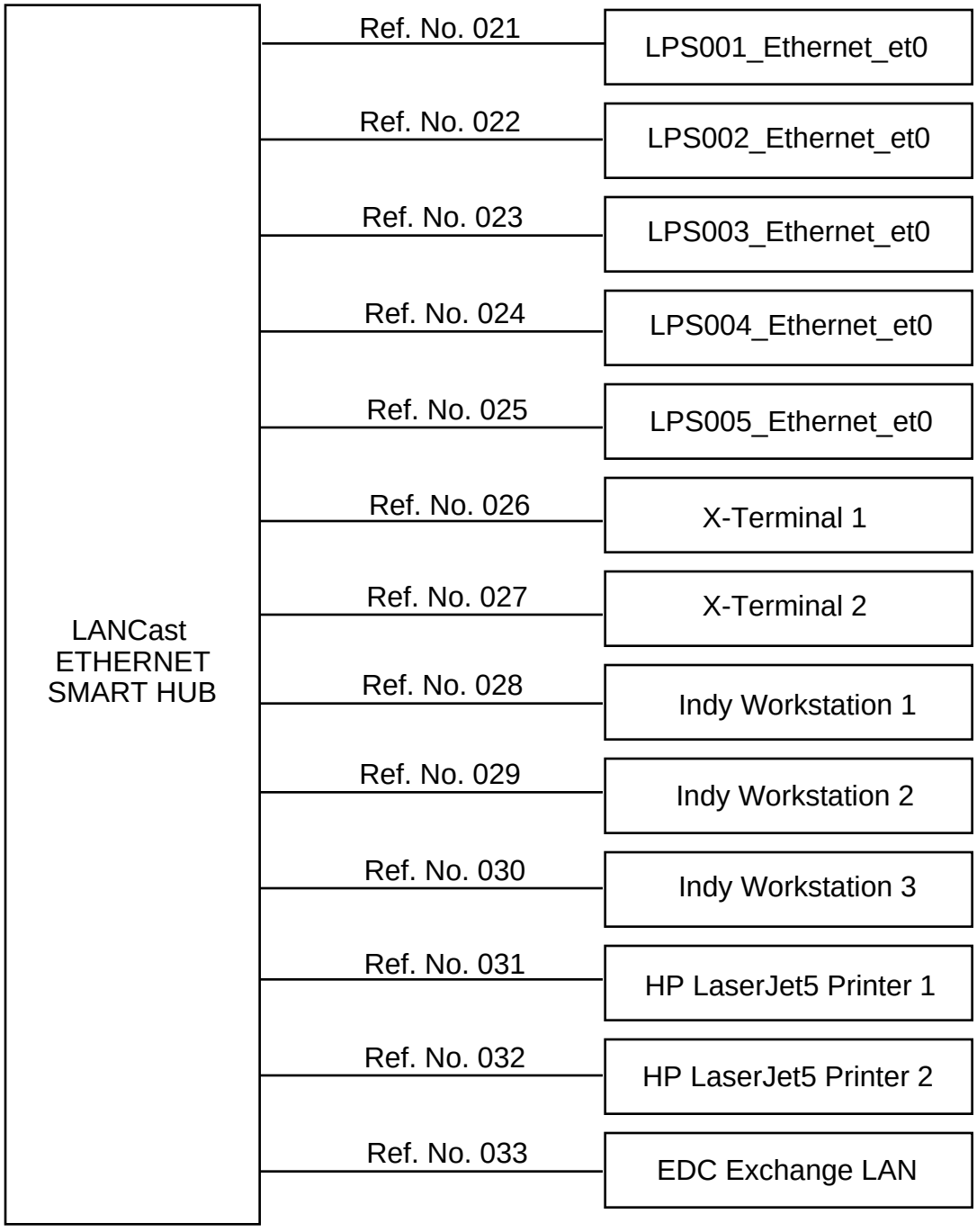
Each end of cable is labeled by the following scheme:

FROM <system name>_<port name>_<signal name>_<input/output>
TO <system name>_<port name>_<signal name>_<input/output>

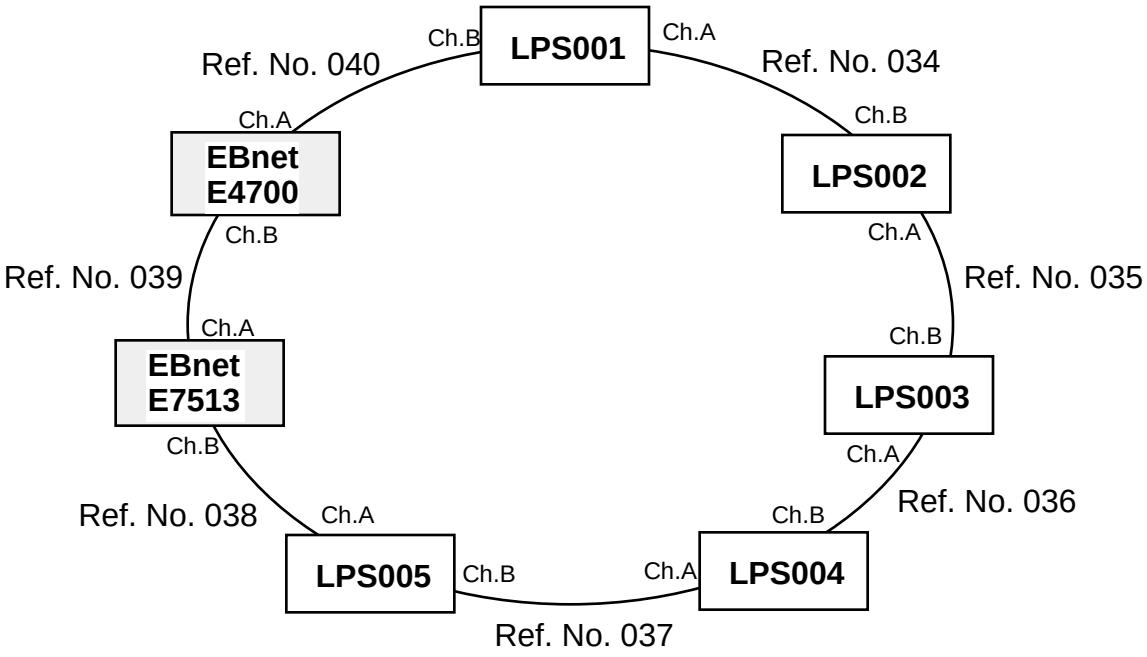
Appendix C—LPS Interconnection Diagrams



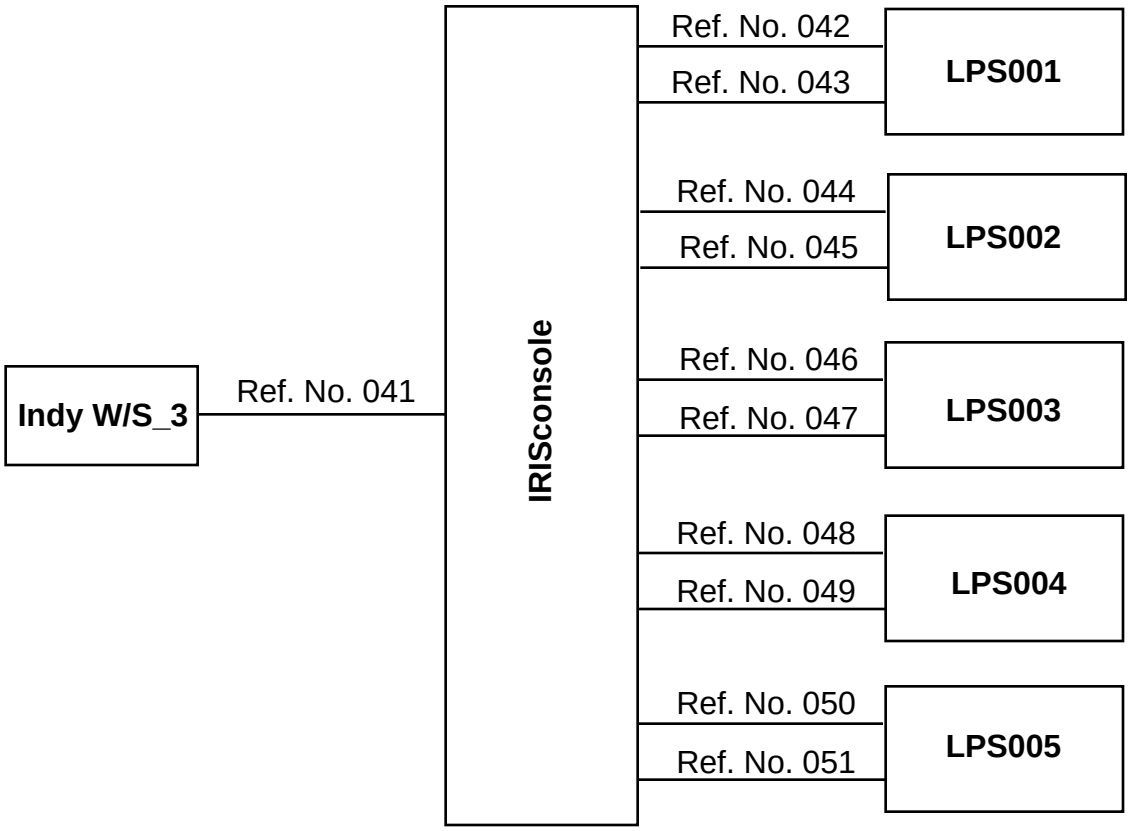
Challenge XLs and Other Devices Interconnection Diagram



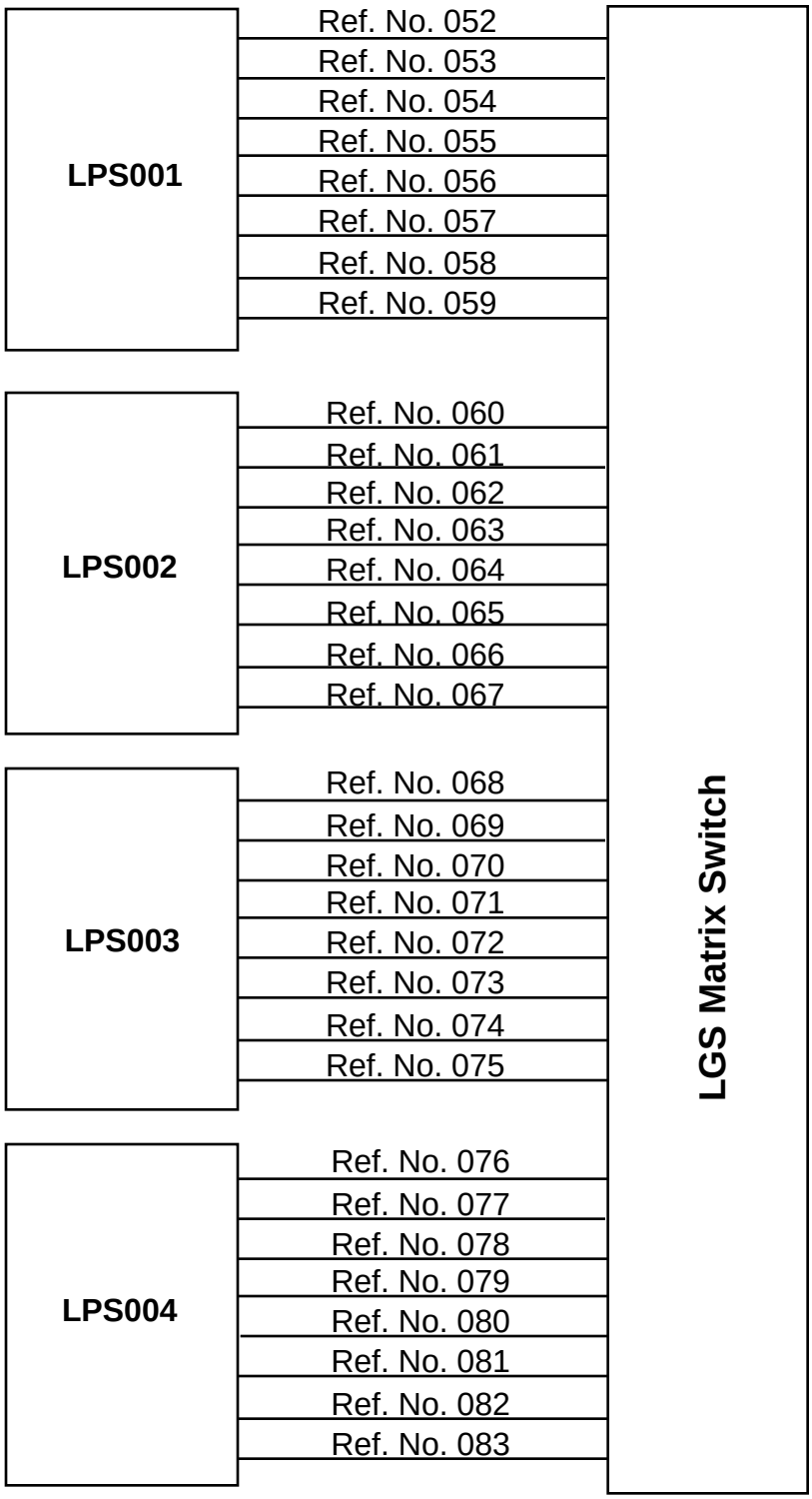
LPS Ethernet Network Interconnection Diagram



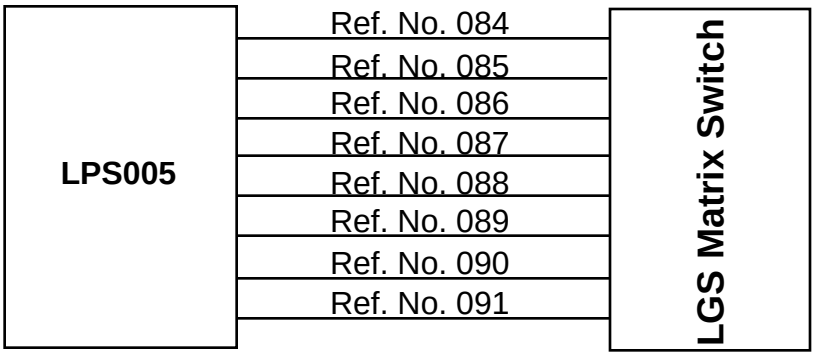
LPS FDDI Network Interconnection Diagram



IRISconsole and Other Systems Interconnection Diagram



LPS Systems and LGS Matrix Switch Interconnection Diagram



LPS Systems and LGS Matrix Switch Interconnection Diagram (Cont.)

Appendix D—LPS Host Name and IP Address (TBD)

System Name	Host Name	IP Address
Challenge XL 1	lps001	
Challenge XL 2	lps002	
Challenge XL 3	lps003	
Challenge XL 4	lps004	
Challenge XL 5	lps005	
Indy Workstation 1	indy1	
Indy Workstation 2	indy2	
Indy Workstation 3	indy3	
X-Terminal 1	lpsx001	
X-Terminal 2	lpsx002	
HP LaserJet 1	hp1	
HP LaserJet 2	hp2	

Appendix E—Preventative Maintenance Schedule

System Name	Preventative Maintenance
SGI Challenge XL	Clean the 4mm DAT drive every 25 hours of use; Clean the 8mm tape drive once every 30 GB of data transferred, or after 15 passes
Indy Workstation	Not required
X-Terminal	Not required
IRISconsole	Not required
Ethernet 10 Base-T Smart Hub	Not required
Digital Linear Tape 4700	Clean drive head when it is dirty, or the data cartridge is bad
HP LaserJet 5 Printer	Clean the printer every time changing the toner cartridge, or whenever print quality problems occur
Epson LQ-570PLUS Printer	Clean the printer thoroughly several times a year
6700 Disk Arrays, Model AR 6702	Clean the air filter once every six months, or more frequently if the environment is dusty or the subsystem is in an exposed area.

Appendix F—Ciprico 32 GB RAID disk partition & xfs file structure

Disk partition table:

----- partition ----- part	type	cyls	blocks	megabytes (base+size)
0:	xfs	2+2	36288+ 36288	18+18
1:	raw	4+4	72576+ 72576	35+35
6:	xfs	8+3690	145152+ 66951360	71+32691
7:	xfs	2+3696	36288+ 57060224	18+32744
8:	volhdr	0+2	0 + 36288	0+18
10:	volume	0+3698	0 +67096512	0+32762

xfs file structure:

meta-data	=/dev/dsk/dksxxxd1s7	isize=256	agcount=32, agsize=261954 blks
data	=	bsize=4096	blocks=8382528
log	=internal log	bsize=4096	blocks=1000
realtime	=none	bsize=65536	blocks=0, rtextents=0

Acronyms List

ac	alternating current
BIST	Built-in self test
BTU	British thermal unit
<CR>	Carriage return
CCB	Configuration Control Board
CD ROM	Compact disk read only memory
COTS	Commercial off the shelf
CPU	Central processing unit
DAAC	Distributed Active Archive Center
DAT	Digital audio tape
dc	direct current
DCN	Document Change Notice
DLT	Digital linear tape
DSP	Digital signal processor
ECL	Emitter-Coupled-Logic
EDC	EROS Data Center
EEPROM	Electrically erasable programmable read only Memory
EROS	Earth Resources Observation System
ETM+	Enhanced Thematic Mapper Plus
F/W	Fast and wide
FDDI	Fiber distributed data interface
FIFO	First in first out
FTP	File Transfer Protocol
GB	Giga Bytes
GSFC	Goddard Space Flight Center
HDF	Hierarchical Data Format
HP	Hewlett Packard
HPDI	High speed parallel digital interface
IP	Internet Protocol
IPD	Information Processing Division
IO	Input/Output
LAN	Local Area Network
LED	Light Emitting Diode
LGS	Landsat 7 Ground Station
LOR	Level OR

LPS	Landsat 7 Processing System
Mhz	Megahertz
MO&DSD	Mission Operations and Data Systems Directorate
NASA	National Aeronautics and Space Administration
NCSA	National Center for Super computing Applications
NRZ-L	Non-return to zero-level
O&M	Operations and Maintenance
POST	Power-on self test
RAID	Redundant Array of Independent Drives
RAM	Random access memory
S/N	Serial number
SE	Single-ended
SCSI	Small computer system interface
SGI	Silicon Graphics Incorporated
SRAM	Static random access memory
TTY	Teletype
VAC	Volts alternating current
VCAM	VMEbus Channel Adapter Module
VME	Versa Module European
VSIO	Very high speed serial interface
W	Watt